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# AVIATION SAFETY LETTER

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*Learn from the mistakes of others;  
you'll not live long enough to make them all yourself...*

Canada

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## GUEST EDITORIAL

### Upcoming Regulatory Initiatives

As a regulator, we're continuously trying to advance aviation safety. Due to this, there is always work being done on regulatory files and Civil Aviation continues to look for ways to improve the rulemaking process. This is the goal of the CARAC Modernization Project, which is moving the rulemaking process towards enhanced efficiency through streamlining, reduced process burden, as well as early prioritization and focused analysis of issues. This modernized process has already been piloted on regulatory files, including proposed regulations for offshore helicopter operations, which was in response to an accident involving a Sikorsky S-92A helicopter.

Listed below you will find the regulatory initiatives that are expected to be submitted for publication in the *Canada Gazette*, Part I and Part II between now and the end of 2014.

### Offshore Helicopter Operations

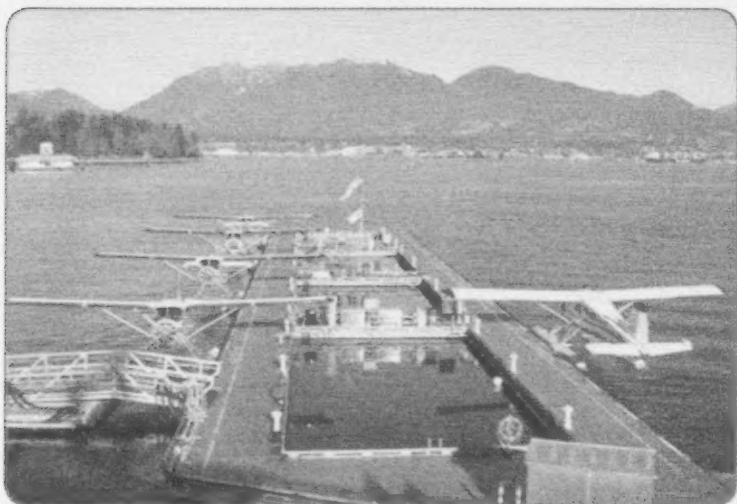
This proposed amendment would introduce regulations that would prohibit offshore helicopter operations when weather or water conditions make ditching in the water unsafe, require operators to carry emergency underwater breathing apparatus for each passenger onboard offshore flights, and require all crew members to wear a water immersion survival suit specifically designed for crew. This proposed amendment is in response to Transportation Safety Board (TSB) recommendations following the March 12, 2009, accident involving a Sikorsky S-92A helicopter which crashed in the Atlantic Ocean near Newfoundland.

### Multi-Crew Pilot License (MPL)

This amendment will introduce a new internationally recognized competency-based pilot licence, the Multi-Crew Pilot Licence (MPL). The MPL will permit holders to act as co-pilots for air carriers operating complex modern transport category aircraft. Currently, pilots wanting to work as co-pilot of transport category aircraft must get a specific commercial pilot licence and acquire extensive experience operating smaller multi-engine aircraft. MPL training is an innovative, structured and competency-based program specifically targeted towards developing the skills and knowledge required to become an airline co-pilot. An air carrier would be able to employ the holder of this new licence as a first-officer second officer or a cruise-relief pilot with the assurance that the pilot had undergone the necessary training.

### Private Operators — CAR 604

The proposed amendments would return full responsibility to Transport Canada for processing the registration of private operators and assessing continued compliance to standards. These amendments would include requirements regarding registration, flight operations (minima for takeoff, approaches and landings), personnel requirements and training programs, emergency equipment, maintenance requirements and safety management systems (SMS).



Vancouver Harbour Water Aerodrome, Vancouver, British Columbia



Martin J. Eley

### Water Aerodromes

New Subpart 306 sets out the minimum safety criteria required for a water aerodrome to be certified as a water airport. Highlighted in the proposed regulations are safety requirements at water airports and the responsibilities and obligations of water airport operators. These proposed regulations would be both performance based (e.g., level of service, times of operation) and prescriptive (e.g., physical characteristics of landing areas, dimensions of obstacle limitation surfaces).

## In Closing

The Policy and Regulatory Services branch and the Standards branch of Civil Aviation work together to provide the best legislation and rulemaking process for Canada and Canadians, as well as promote aviation safety by ensuring compliance with the *Canadian Aviation Regulations* and the *Aeronautics Act*. These branches have been hard at work ensuring that the civil aviation regulatory initiatives mentioned above, and many others, move forward.



Martin J. Eley  
Director General  
Transport Canada Civil Aviation



## TO THE LETTER

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### A Short Story About "Hole Hopping"

It was a sunny summer day. My friend, her daughter and I decided to go exploring with the airplane, a four-place high-wing. After spending a few hours at our destination, we decided to leave for home because weather was coming into the area.

Flight service told me that weather at home base was marginal VFR in light rain. That was not a problem as I passed by an alternate, in VFR conditions, less than a half hour from home base. I was flying at 3 500 ft AGL under 4 000 ft overcast; there was no precipitation and good visibility.

We were 15 minutes from home base; ahead of me was reduced visibility in light rain and a thin layer of cloud at 3 000 ft. To drop beneath that layer would mean another half hour flying around a hazard. But if this 3 000-ft layer was scattered, then I would only be above it for 5 minutes or so. From my shallow angle, it appeared to be broken. I have flown over broken cloud in the past for various reasons, always keeping a "safety hole" in sight. I kept going. Within 15 seconds, I passed a large enough hole to drop through. I looked out into the reduced visibility. I had a bad gut feeling.

Twenty seconds later, I was losing definition between my two cloud layers. My gut feeling screamed at me, and I did a 180° turn towards my "safety hole". At the hole, I put on half flap, reduced throttle and entered a steep spiral dive. The hole was now filling in and I wouldn't make it. I pulled up. My fear was coming on strong. I saw some cloud definition above me in the distance. Flaps off and into a full power climb, I couldn't out climb the cloud forming around me. My heart was racing.

I leveled off and entered a turn. I was being squeezed into an ever tightening turn. The stall warning was sounding continuously now. The instruments meant nothing to me. I was panicking inside and straining desperately to maintain any bit of visual reference to cloud definition. Some cloud definition straight ahead! I headed for it, still in slow flight. I'm losing sight of it! The cloud is building around me! Again, I was forced into a steep turn.

With the cloud still forming, I could just make out some cloud definition so I still knew which way was up. I was now completely trapped and stuck in a steep turn with the stall warning still sounding. It was hideous! I was terrified and as I waited for the cloud to consume me, I thought to myself: "I've really done it now, I've got about two minutes and it's all over. I'll be in a spin or a spiral dive." Then, whiteout! I was in a cloud. At that exact moment, I felt that we were flying straight and level. It felt like I had fallen prey to this death-trap cloud. And my panic was somewhat relieved with the surrender that I now felt.

Then, I caught a glimpse of the instruments. The bright blue of the artificial horizon caught my attention and confirmed a left bank, about 60°. Suddenly, a flash of cloud definition running 60° appeared across the window. Instinctively, the plane rolled level. We popped out of the cloud! I nosed down and the stall warning went silent.

I dropped below the cloud and flew home without incident. I was embarrassed and quiet. I was feeling the shame of putting my friends into a life-threatening situation and I was trying to hide it.

How could I hide it? I remembered boarding the airplane with the bad weather approaching, and my friend's daughter expressing her fear, and her mother telling her "don't worry because he [me] would never do anything to put us in danger." This incident all took place in under three minutes and within one sq. mi. (retrieved from the GPS-stored track).

As afterthoughts, I didn't ever think this would or could happen to me. What saved us?

- a) The high-wing didn't stall (I couldn't make the stall warning go silent because I was panicking and reacting to my loss of visual reference).
- b) We popped out of the cloud before we went into an unusual attitude.

I always thought that I could outrun a cloud. While that may be true, I now know that I can't outrun a cloud that is forming. I believe this is the trap: From a distance, one doesn't really notice a cloud when it's forming. So I was lulled into believing that it is a slow and gentle process. But now, having flown in a cloud that is forming around me, I know that there is no outrunning it.

I am writing this, not for the potential reader, but for myself. This may not save anyone's life, because you see, a few years ago, I was invited to a private storytelling by a pilot who had done the same thing. His story ended in a crash. There were tears in his eyes and his voice quivered as he recounted the moments of terror that he had lived through one month prior. With the emotion that he displayed, I was able to relive it with him and was grateful for the experience, thinking that I had learned from his mistake.

In his story, I assumed that the layer below him was solid because he didn't say otherwise. So in my mind, "hole hopping" over a broken layer was still safe. Isn't it?

Name withheld

*Thank you so much. The following image, from one of our popular aviation safety posters, summarizes well the morale of your story!*  
—Ed.



## Tried and Tested: The Pilot Decision-Making Simulator



In December 2009, as a follow-up to the Safety Study on Risk Profiling the Air Taxi Sector in Canada, we made available on the Transport Canada Web site the Pilot Decision-Making Simulator, developed by inspector Gerry Binnema (now retired from TC).

This simulator was developed utilizing real life scenarios and has relied heavily on pilots' personal experiences as well as TSB investigations. The simulator will expose pilots to difficult decision-making processes and the resultant outcomes from their choices, and in doing so, highlight cues that may have otherwise gone unnoticed.

Situational awareness is key to the safe operation and completion of any flight. The goal of the decision-making simulator is to aid pilots with the development of useful mental models and consequently increase their ability to develop good situational awareness. Even the best trained crews and pilots can make poor decisions without good situational awareness. Try it!



## PRE-FLIGHT

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### Shoulder Harnesses and Seat Belts—Double Click for Safety

by Rob Freeman, Civil Aviation Safety Inspector, Commercial Flight Standards, Standards Branch, Civil Aviation, Transport Canada

Excerpt from a recent Transportation Safety Board report:  
*"The pilot's shoulder harness was found post accident tucked into a storage pouch behind the seat."*

If you are like most of us, you don't even think about putting on your seat belt and shoulder harness when you get into your car. You just do it. It's been a long time since people actively fought against the seat belt law in Canada. Yet years ago, it was commonly held that you were actually safer if you were ejected from the vehicle during a collision! Now it feels uncomfortable to move a car even a short distance without being strapped in. So it is a bit of a surprise to find that many of the same pilots who drive their vehicles to the airport while buckled and secured do not attach their shoulder harnesses when they go flying.

We know that to be true because aircraft accident investigations often reveal the sad reality—survivable accidents aren't survived, and the ever-present crew shoulder harnesses that are required to be installed on all aircraft manufactured after the dates specified below have been neatly tucked away or secured behind the now-deceased pilot's seat. The FAA has estimated that roughly one third of all general aviation accidents with fatalities would have been survivable if the pilots had been using their shoulder harnesses.

[www.faa.gov/aircraft/gen\\_av/harness\\_kits/system\\_accidents/](http://www.faa.gov/aircraft/gen_av/harness_kits/system_accidents/)

For cars and aircraft, it is the secondary collision that kills. The dynamics of the deceleration sequence in a sudden-stop accident are straightforward and have been well understood for a long time. The vehicle (either car or aircraft) undergoes a sudden and complete deceleration during contact with an immovable surface (ground or water). The driver or pilot is still moving forward at the original velocity and now pivots from the waist, where he or she is secured only by the lap belt. No one is physically strong enough to prop themselves up against the high g-force deceleration that may occur during an accident sequence, so heads and arms strike the dashboard or instrument panel violently.

These days drivers and their passengers may be saved by airbag deployment, but that is not the case in most aircraft. Pilots are often rendered unconscious or unable to extract themselves from the wreckage due to serious injuries or

shock. Hypothermia, drowning or fire is often the second and final complication for the incapacitated crew and their trapped and panicked passengers.

The intent of the *Canadian Aviation Regulations* (CARs) is that pilots wear both the lap strap and shoulder harness where installed. Where there are two pilots, at least one must wear the safety belt (lap strap and shoulder harness) at all times while in flight.

Here are some excerpts from the CARs concerning the use of safety belts that apply specifically to pilots. Sections referring to other occupant restraint systems have been excluded for clarity and brevity.

#### Canadian Aviation Regulations (CARs)

##### Interpretation

**101.01** (1) In these Regulations:

"safety belt" means a personal restraint system consisting of either a lap strap or a lap strap combined with a shoulder harness; (*ceinture de sécurité*)

"crew member" means a person assigned to duty in an aircraft during flight time; (*membre d'équipage*)

"flight crew member" means a crew member assigned to act as pilot or flight engineer of an aircraft during flight time; (*membre d'équipage de conduite*)

##### Seat and Safety Belt Requirements

**605.22** (1) ...no person shall operate an aircraft other than a balloon unless it is equipped with a seat and safety belt for each person on board the aircraft other than an infant.

##### Shoulder Harness Requirements

**605.24** (1) No person shall operate an aeroplane, other than a small aeroplane manufactured before July 18, 1978, unless each front seat or, if the aeroplane has a flight deck, each seat on the flight deck is equipped with a safety belt that includes a shoulder harness.

(4) No person shall operate a helicopter manufactured after September 16, 1992, the initial type certificate of which specifies that the helicopter is certified as belonging to the

normal or transport category, unless each seat is equipped with a safety belt that includes a shoulder harness.

(5) No person operating an aircraft shall conduct any of the following flight operations unless the aircraft is equipped with a seat and a safety belt that includes a shoulder harness for each person on board the aircraft:

- (a) aerobatic manoeuvres;
- (b) class B, C or D external load operations conducted by a helicopter; and
- (c) aerial application, or aerial inspection other than flight inspection for the purpose of calibrating electronic navigation aids, conducted at altitudes below 500 feet AGL.

### **Use of Crew Member Safety Belts**

**605.27** (1) Subject to subsection (2), the crew members on an aircraft shall be seated at their stations with their safety belts fastened.

- (a) during take-off and landing;
- (b) at any time that the pilot-in-command directs; and...
- (2) Where the pilot-in-command directs that safety belts be fastened by illuminating the safety belt sign, a crew member is not required to comply with paragraph (1)(b).
- (c) if the crew member is occupying a crew rest facility during cruise flight and the restraint system for that facility is properly adjusted and securely fastened.
- (3) The pilot-in-command shall ensure that at least one pilot is seated at the flight controls with safety belt fastened during flight time.

Note that the definition of *safety belt* includes a lap strap OR a lap strap AND shoulder harness, to address all aircraft, including those exempted from having shoulder harnesses due to their age and original basis of certification. The definition was not intended to provide an either/or choice to the flight crew. Unfortunately, that has become a common interpretation. It does not help that unlike automobiles, where both the lap strap and the shoulder harness are

generally a combined unit that cannot be separated; aircraft systems normally permit lap straps and harnesses to be latched individually. This tends to reinforce the widespread misunderstanding of having a choice when strapping in.

CAR 605.27(3) requires one pilot to be fully restrained at all times when the aircraft is in flight. Where the aircraft is operated by a single pilot, then that obligation applies to him or her without exception.

Pilots of some aeroplanes have pointed out that the layout of the instrument panel and controls make it impossible to reach those controls when the shoulder harnesses are attached. Similarly, helicopter pilots involved in longline operations complain that twisting sideways to monitor the load is very uncomfortable or not manageable when the shoulder harness is attached.

Operators, as part of their SMS programs for identifying hazards and for constant improvement, should be addressing these issues within their organizations to see what can be done. There are very few low-cost improvements that can be implemented so simply and have such a profound increase in safety and crew survivability as the constant use of pilot shoulder harnesses.

Aftermarket installation of inertia reel harnesses might be one solution for aircraft that do not have these devices; relocating switches or avionics control heads may be another. Some helicopter models can now be retrofitted with crew seats that have some swiveling capability specifically for longline operations.

As a start, we strongly suggest that you include a line "**shoulder harness – fastened**" on your pre-flight and pre-landing checklist and keep it attached whenever the aircraft is in motion, particularly during takeoff and landing. If you have to unfasten your shoulder harness when it interferes with cockpit duties, get into the habit of reattaching it as soon as you can.

The risk remains that not attaching or removing your shoulder harness for whatever reason and continuing to fly without it will multiply the severity of any crash; perhaps, and most sadly, beyond the point of survival.  $\Delta$

## **Invest a few minutes into your safe return home...**

...by reviewing the Civil Aviation Safety Alert (CASA) 2011-01, titled "SAFETY INFORMATION REGARDING GROUND AND AIRBORNE ICING". The purpose of this CASA on ground and airborne icing is to highlight the fact that continued aircraft operations in icing conditions introduces additional risks. It's time well spent!

## The Danger of Laser Strikes—Increasing in Power and Frequency

by NAV CANADA

The following are a few vivid examples of both the increasing power and frequency of aviation laser strikes:

- At 0323Z on April 18, 2013, a US Air Force C-17 was illuminated by a laser. Given that this is a global combat support aircraft, many may not consider this unusual—however the aircraft was overflying Rivière-du-Loup, Que., at 31 000 ft when the strike occurred.
- A Cathay Pacific Boeing 777 had to conduct a missed approach at Vancouver International Airport due to distractions from a laser strike on March 30, 2013.
- There have been media reports that the pilot of the Asiana Boeing 777 that crashed at San Francisco on July 6, 2013, was “blinded by a bright light”. While this has not been—and may never be—substantiated, the report starkly illustrates the potential danger of a laser strike to aircraft, particularly on short final approach through landing.

### Increasing power of handheld lasers

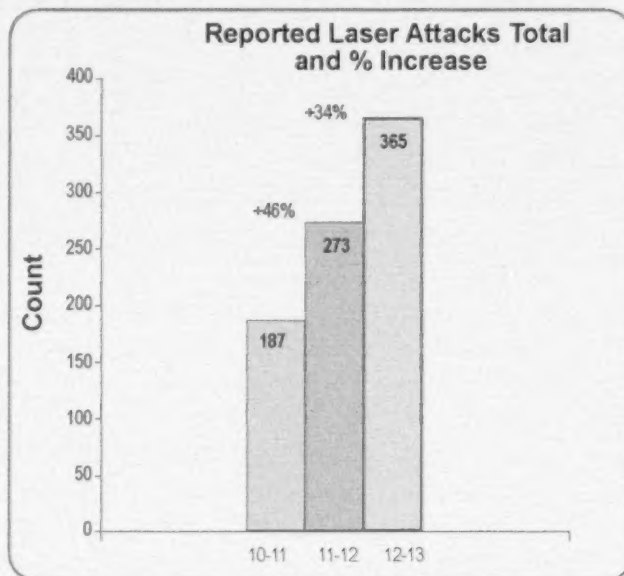
While advancement of laser technology has generated many positive benefits, the greatest danger to aviation may be the general public’s lack of understanding of the power and potential impact of handheld devices on pilots. Most people are still of the belief that all handheld lasers are toys and still associate these devices with the 1 milliwatt (mW) red laser pointers that many used to carry on their key chains.

Today’s reality is significantly different; a handheld 1.4 W class IV laser (1 400 times brighter than your old 1 mW key chain pointer) can be purchased for under \$400. This particular laser is visible up to 100 mi. away—quite literally observable from space and with a beam that is visible in daylight. The manufacturer describes this device as “*strong enough to burn holes, pop balloons and start fires from across the room*”. Such devices are far more than presentation pointers.

While there are some valid uses for handheld lasers, such as astronomy, those uses don’t require the high-power handheld lasers now available. In fact, some pilots wisely carry laser flares; however these devices do not create a focused beam and are expressly designed and approved for search and rescue purposes only.

### Increasing frequency of laser strikes

In part due to the low cost and increasing availability of these devices, the number of laser strikes on aircraft is increasing rapidly.



### Actions being taken by various aviation agencies

To mitigate the increasing risk to aviation, coordinated actions have been formalized between many NAV CANADA ATS units, law enforcement agencies, police dispatchers and Transport Canada enforcement officials to rapidly react to aviation laser strikes. As an example, in the Vancouver FIR, the following process has been put in place:

- A pilot reports a laser illumination to ATS personnel.
- ATS personnel notify police dispatch and, when possible, provide updates on the position of the laser emissions.
- Police are quickly dispatched—using air services where available—to attempt to locate the emission source and apprehend the individual(s) involved.
- In the case of CYVR, the RCMP makes every effort to meet the impacted flight crew and take their statements to further support prosecution.

The results to date are encouraging—as of May 2013 (the first 10 months of this coordinated action), there were:


- 16 reported laser strikes,
- 13 police responses,
- 4 arrests, and
- 1 conviction (with more prosecutions proceeding through the legal system).

### Actions for pilots receiving laser illumination

- If you are struck by a laser—don't overreact: Aviate, Navigate, Communicate.
- Give your eyesight some time to readjust and follow your company's procedures.
- If you are able to locate the source of the laser without further endangering yourself, pass that information along to ATS personnel who will coordinate with law enforcement.

Visit the Transport Canada's "Use Laser Pointers Safely and Legally" Web page, where you will find how to submit a Directed Bright Light (DBL) report.

Finally, Transport Canada has an excellent guide on preparing for a laser strike, including actions to take in the event of receiving a laser illumination, which can be found here:

<http://www.tc.gc.ca/eng/civilaviation/publications/tp202-1-00-530-3984.htm>. 

### Risks in Aviation

by Jean-Gabriel Charrier

*Below you will find a translation of a chapter from Jean-Gabriel Charrier's fine book L'intelligence du pilote. Further extracts from the book will appear in forthcoming issues of the Aviation Safety Letter.*

#### The reality of risk for pilots

As a pilot, you are more vulnerable if you are not aware of the hazards that you face, and prevention starts with information. Light aviation is about 50 times more dangerous per hr than driving; depending on the country, the number of deaths varies between 2 and 5 per 100 000 flying hr. Some types of aircraft, such as helicopters and antique planes, are more prone to accidents than others.

If you fail to keep risk present in your mind, then all the regulations, training and safety instructions will serve little purpose, and any precautions you have taken will probably not be sufficient to keep you safe.

#### Accidents are not inevitable

German pilot Bruno Gantenbrink, former world glider champion in the mid-1990s, had this to say, based on his many years of experience:

*Gliding is the most dangerous thing I've ever done in my life. So why don't I stop? Good question. I don't stop because gliding gives me more joy and pleasure than anything else I can think of as an alternative.*


*However there is also a second reason, which is why I'm writing this. I do not think gliding is intrinsically dangerous. It could be much less dangerous if we were aware of the hazards and acted accordingly. Unfortunately, that is not the case. Being myself very*

*aware of the hazards, I take care to act on this knowledge, and as a result, I hope to be able to beat the statistics.*

*Without that hope, if gliding were as dangerous for me as the statistics seem to suggest, I would stop at once.*

*Almost all the friends I've lost in flight succumbed to human error or pilot error. They made ridiculously small mistakes and neglected the simplest things, with fatal consequences. They died because, at that vital moment, something other than safety was more important in their minds. If gliding is to become less dangerous, it won't be enough to take this or that action. Instead there needs to be a basic shift in attitude. And that won't happen unless we make a realistic assessment of the hazards we are facing on an almost routine basis.*

**Gantenbrink's thoughts should be pondered by all pilots involved in light aviation.**

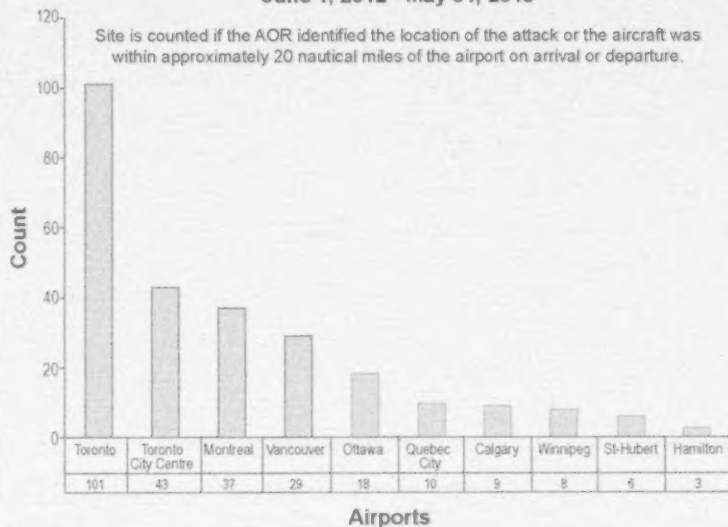
 **Your safety depends first and foremost on you, on your attitude.**

#### Concepts of risk

**An accident is a confrontation with risk that goes wrong:** a poorly executed landing in a crosswind; loss of control under demanding flying conditions. Pilots need to avoid these accident-producing situations. And one way to do that is to improve your perception of the risks related to the type

### Top Airports for Laser Attacks

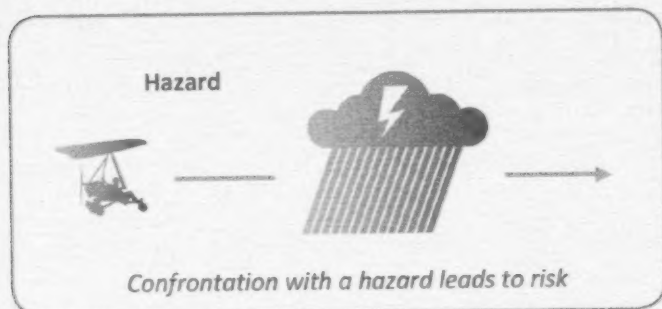
June 1, 2012 - May 31, 2013



of flying you do. Here are some concepts that will give you a better understanding of risk.

### *Risk or hazard?*

Before looking at the concept of risk, we need to talk about hazards, because in aviation, **risk arises from a confrontation with or exposure to some hazardous phenomenon, i.e. a physical threat.**



If you are aware of the hazards, you can avoid them. So for example if you are unfamiliar with downdrafts, you should avoid flying over mountains when winds are high as this will generate downdrafts. In some cases, it is fine to confront a hazard, but only if you know how to deal with the phenomenon in question: the risk of carburetor icing can be controlled by a knowledge of the conditions under which it occurs and of how to use carburetor heat.

### *Seriousness and likelihood*

Risk is thus a confrontation with a hazard which you do not know how to control and which may lead (with some degree of likelihood) to an accident (of some degree of seriousness). Taking off without doing certain routine checks is liable to create a risk. Failing to read NOTAMs increases the probability of an accident, though this may be less serious than failing to top up your tank. **The more likely and the more serious a risk, the more critical it is.** If you fly all the time (high degree of likelihood) without checking a vital aspect of your aircraft (high degree of seriousness), the risk becomes critical.

### *Avoiding, mitigating and accepting risk*

When you notice a big squall cloud ahead of you en route, you are identifying a hazard. There are three courses of action open to you: avoid the risk, limit it, or accept it. If you go around, you will not confront the hazard and thus you will not be taking a risk. If you decide to fly on the side of the cloud that seems least active, rather than under it, then you are mitigating the risk. Finally, you can continue on your present heading if you think the risk is acceptable.

✋ **For pilots, especially recreational pilots, the prime tool for managing risk is avoiding hazards.**

### *Ignorance of hazards as a risk factor*

The degree of risk, as we've seen, is measured by multiplying seriousness by likelihood, but a third factor commonly mentioned is failure to detect the hazard. **If, through ignorance, the hazard is not identified, then the probability of being confronted by it becomes much greater.** For example, a pilot enters a valley without noticing that it rises and narrows, and he continues despite signs of deteriorating weather which he does not understand.

### *Experience and risk management*

**Risk perception will grow with experience**, which will improve your judgment and the quality of your decisions. You will find it easier to notice risky conditions, such as fog which may obscure the horizon when you are flying over water or arrival at an unknown airport when there is a lot of traffic. With experience, you will be able to identify these conditions, which previously had no meaning for you. However, experience should not lead you to take greater risks, to "take things to the next level", under the assumption that you are in control of the situation. This widespread tendency to keep "pushing your limits" is contrary to the objective of any flight, which is to get the aircraft, its passengers and its crew safely home.

### *Prevention versus precaution*

Risk prevention is based on knowledge: knowledge of the environment (hazardous phenomena, low fuel, heavy traffic), of your aircraft and of your own limitations. **A precautionary approach is different but complementary: you take precautions when you lack precise knowledge of hazards or suspected risks, or there is doubt about whether you can control them.** Taking precautions means increasing your safety margin in the face of a perceived or probable hazard: wait until visibility increases; go around a Terminal Area, taking a longer route; request a different runway; or just cancel your flight if you don't have a good feel for the situation or just want to be safe rather than sorry!

### *Objective versus subjective risk*

There is a difference between real (objective) risk and perceived (subjective) risk. The source of this difference is ignorance, inexperience or overconfidence. Also, there is a tendency to underestimate risks which you yourself are taking. **If you are taking an action yourself, you have a (subjective) feeling of controlling risks**, though this may not be the case. A good deal of the content of training courses as well as information for pilots is directed at reducing the gap between subjective and objective risk.

### *Risk and regulations*

In the world of aviation, regulations are mainly a way of managing risk. However, regulations need to be adapted to numerous special cases. Often a compromise is made

that leaves the door open to risk. For example, 15 min after sunset, it will be dark in a valley if the sky is overcast, whereas it will be bright over flat land if skies are clear. Unlike the case with commercial passenger aviation, where nothing is left to chance, in recreational aviation things are much more “open”, much less regulated. You need to be aware of this, because it means that the hazards are more numerous. You need to know about them, and associate with them a risk assessment that is as objective as possible. **Most accidents occur even though there is full compliance with the regulations.**

### *Acceptability of risk varies with the pilot*

Every pilot has his own perception of risks, and this will determine their acceptability. Perception and acceptance of risk will be influenced by your training, experience, education, personality and beliefs. These factors will affect your reasoning and your attitude. Also to be noted is the problem of rash behaviour, especially among young pilots who are trying to find out how far they can go.

### *The importance of humility*

As a pilot, your thinking needs to be based not only on your knowledge but on being **aware that there is much you do not know**. That recognition will encourage you to be careful. **Humility is essential for a pilot.**

### △ *Key points*

- ✓ In light aviation, most accidents are due to a lack of caution. Be wary of the insidious and dangerous feeling of invulnerability.
- ✓ Ignorance or underestimation of risk leads many pilots to go beyond their limits, whether unconsciously or deliberately. The risk then becomes more serious and more probable.
- ✓ Compliance with regulations does avoid some risks, but does not guarantee safety.
- ✓ While light aviation may be a recreational activity, it calls for the strictest of attention at all times.
- ✓ Accidents don't happen by chance. If the factors that may lead to an accident are analysed before the flight, the likelihood of an accident can be greatly reduced. Many accidents result from ignorance, and sometimes from contempt for elementary rules.
- ✓ If you have any doubts about your ability to handle a situation, then avoid trouble: it's better to turn back or to cancel the flight than to take pointless risks. Your ego will recover! △

## TC AIM Snapshot: Contaminated Runway Operations

At Canadian civil aerodromes where snow removal and ice control operations are conducted, assessment and mitigation procedures are carried out to the extent that is practicable in order to provide movement surfaces that will permit safe operational use.

Pilots who are confronted with conditions produced by the changing Canadian climate must be familiar with and anticipate the overall effect of contaminated runways on aircraft handling characteristics in order to take any corrective actions considered necessary for flight safety.

In general terms, whenever a contaminant such as water, snow or ice is introduced onto the runway surface, the effective coefficient of friction between the aircraft tire and runway is reduced. However, the accelerate/stop distance, landing distance and crosswind limitations contained in aircraft flight manuals are demonstrated in accordance with specified performance criteria on bare and dry runways during the aircraft certification flight test program, and are thus valid only when the runway is bare and dry.

As a result, the stop portion of the accelerate/stop distance will increase, the landing distance will increase and a crosswind will present directional control difficulties.

It is therefore expected that pilots will take all necessary action, including the application of any appropriate adjustment factor to calculate stopping distances for their aircraft as may be required based on the runway surface condition and Canadian Runway Friction Index (CRFI) information.

(Ref: Transport Canada Aeronautical Information Manual (TC AIM), Section AGA 1.1.5)



## FLIGHT OPERATIONS

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### A Diamond in the Rough

*A summary of National Transportation Safety Board (NTSB) report ERA11FA182.*

*In early 2011, a prominent businessman, builder and community leader from Toronto lost his life in an aircraft accident in a remote area of the northeastern USA. Referred to in the NTSB report as the “pilot-rated passenger” or “PRP”, this gentleman was flying back from Halifax to Toronto in his own Diamond DA-40, accompanied by a commercial pilot whom he had hired to act as pilot-in-command. The flight planned to cross that familiar route over the State of Maine, a hilly and sparsely populated area used by many of us when flying from the Maritimes to southern Ontario or Quebec. A sophisticated machine and a strong will to make it home were no match for the dire weather conditions that awaited them enroute. Readers are invited to draw their own conclusions and hopefully learn from the account.*

#### History of the flight

On March 7, 2011, at about 13:45 EST, a Canadian-registered Diamond DA-40 was substantially damaged when it impacted a wooded area in the vicinity of Allagash, Maine. The certified commercial pilot sustained serious injuries, and the private pilot-rated passenger was fatally injured. Instrument meteorological conditions prevailed, and an IFR flight plan was filed for the flight from Halifax International Airport (CYHZ), N.S., to Québec Jean Lesage International Airport (CYQB), Que.

According to the pilot-in-command (PIC), on the morning of the accident, he reviewed the weather with the pilot-rated passenger (PRP). He concluded that an enroute area of low pressure prevented them from flying to their final destination, Toronto/Buttonville (CYKZ). The PIC made the decision to wait until noon to re-evaluate their options. By noon, he determined that the low pressure area was moving into the Halifax area the following day. The pilots decided to depart Halifax for Saint John, New Brunswick (CYSJ) where they would wait out the weather associated with the frontal passage. They felt this would expedite the return to CYKZ.

The pilot called London International Airport (CYXU) flight service station (FSS) to file his flight plan. When asked by the FSS if he wanted a weather briefing or notice to airmen (NOTAM), the pilot declined. The flight departed IFR and reached a cruising altitude of 6 000 ft. The PIC stated that the weather in Halifax at departure was rainy with crosswinds. He recalled that they were given a clearance direct to Saint John VOR.

The PIC stated that they monitored the weather during the flight and the weather radar depiction showed mostly areas of rain. He recalled that the weather was better than forecast and that they encountered rain again as they approached Saint John VOR. The PRP questioned the PIC about continuing on to CYQB, as the meteorological aerodrome

report (METAR) and terminal area forecast (TAF) looked good. The PIC reviewed the current METARs and TAFs for the area. Low ceilings and poor visibility in snow were reported. The PIC reported that the weather at CYQB appeared better, so they re-filed their flight plan with the Moncton Area Control Centre to CYQB at 6 000 ft, using St. Georges, Que., (CYSG) as their new alternate. While overflying Saint John VOR, the pilots observed that the temperature was +6°C. The flight continued within areas depicted on radar as rain. The multi-function display depicted a freezing level at 6 000 ft AGL straight ahead and a zone further ahead indicated a 4 000 ft AGL freezing level.

During the flight, the PRP advised the PIC that there was ice formation on the left wing, and the PIC observed the same thing on the right wing. The PIC described the accumulation as no higher than a nickel. The PIC asked the PRP for the outside air temperature and was told that it now indicated +1°C. They discussed the weather and agreed that the situation was not good, as they were in an area of weather that was not visible on the display and the temperature had dropped to +1°C. They discussed their options and decided to descend to a lower altitude.

The PIC requested a lower altitude from the Montreal Area Control Centre (CZUL), which authorized a lower altitude of 5 200 ft. The PIC indicated to the air traffic controller that they were experiencing icing and needed to be at a lower altitude. During the descent, the PIC recalled experiencing the most ice he had ever seen in his life; the canopy had completely frozen over. The front of the canopy and the wings were covered in ice. He described the ice as being as large as a house brick on the leading edge; the ice then extended backwards on the wing for 1 ft, with a thickness of approximately 1 to 2 in.

As they leveled the aircraft at 4 000 ft, the airspeed immediately decreased. Full power was applied,

and the PIC asked the PRP to advise him if the airspeed decreased below 80 kt. The airspeed was observed at 84 kt, and buffeting was experienced in straight and level flight. Ice continued to accumulate on the airplane, and the PIC advised the PRP to start looking for somewhere to land. The airplane continued buffeting and the pilot estimated that they were approximately 1 000 ft AGL. The next thing that the PIC remembered was waking up in the airplane next to the passenger, with no recollection of how long he was unconscious. His feet were in the snow, there was no canopy on the airplane and the engine and panel were missing. He said he knew right away that the PRP was deceased.

### *Personnel information*

The pilot was a licensed flight instructor with a current medical certificate who reportedly had a total of 3 000 hr of flight time, more than 1 500 hr of which were on the DA-40. He had flown approximately 20 hr in the 90 days prior to the accident. He also held a Federal Aviation Administration commercial multi-engine certificate and an instrument rating.

The PRP was the owner of the aircraft. He held a private pilot license with a visual flight rules over the top (VFR OTT) rating. He had approximately 400 hr total flight time. The flight was reportedly planned and flown as a crew, with the workload divided between the pilots. The PRP managed radio calls and monitored the outside temperature for most of the flight.

### *Meteorological information*

The closest unofficial surface observing station was Clayton Lake, Maine, located 17 mi. east-southeast of the accident site; reported winds were from 010° at 7 kt gusting to 14 kt with a temperature and dew point of -7°C and an altimeter setting of 29.75 in. of mercury. The closest official surface observing station with ceiling and weather information was Frenchville, Maine, located 72 mi. east-northeast of the accident site. It reported winds from 020° at 18 kt gusting to 30 kt, 1 mi. visibility, moderate freezing precipitation, a broken ceiling at 900 ft AGL, a temperature of -7°C, a dew point of -9°C and an altimeter setting of 29.77 in. of mercury.

The TAF for the destination location of CYQB, as well as the closest reporting site to the accident site with a TAF, expected wind from 050° at 6 kt, visibility of 1 mi. in light snow and vertical visibility of 1 000 ft AGL. Forecast temporary conditions between 13:00 EST and 16:00 EST called for visibility of 3 mi. in light snow and an overcast ceiling at 2 500 ft.

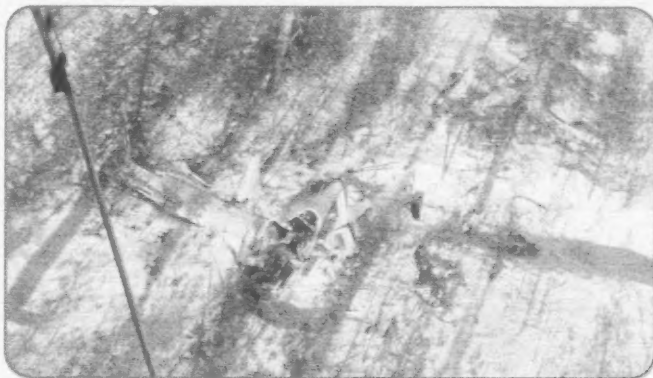
The National Weather Service Area Forecast Discussion issued at 12:49 EST reported a band of stationary freezing rain across north central Maine due to a wedge of warm air aloft. This wedge of warm air was expected to diminish into the afternoon. Snow continued to be expected across

northwest Maine with the highest snow totals located across the Maine Highlands.

Two pilot reports (PIREP) were documented before the accident time with moderate icing conditions reported across New Hampshire and Maine. Both of the aircraft that reported the moderate icing conditions had de-icing/anti-icing capability.

### *Wreckage and impact information*

Wreckage debris and broken tree limbs were scattered about 300 ft along an approximate 200° magnetic heading from a broken tree. The airplane came to rest in approximately 6 ft of snow. The nose and the engine broke away from the fuselage and were buried in the snow. The cockpit of the airplane was exposed and the canopy broke away along the debris path. The right wing was attached to the fuselage but fragmented. The empennage broke away from the fuselage and was buried in snow along the debris path. The left wing broke away from the fuselage at the wing root and fragmented in the snow along the debris path.



Examination of the recovered airframe, engine, flight control system and associated components revealed no evidence of pre-impact mechanical malfunction. Due to the external damage, an engine run could not be performed. During the engine examination, the crankshaft was rotated by hand and valve train continuity and cylinder compression were confirmed.

### *Additional information*

According to NAV CANADA, the flight that transitioned through the area controlled by the Boston Air Route Traffic Control Center (ZBW), located in Nashua, N.H., was an overflight westbound at 6 000 ft. There had been an airman's meteorological information (AIRMET) issued two hr earlier for light to moderate icing below 14 000 ft. The aircraft was issued vectors around mountainous terrain as per the pilot's request, in order to stay low due to potential icing. Lost communication procedures were issued, which was standard in the area and altitude that the aircraft was transiting. The pilot switched to CZUL on his own, in accordance with the lost communication procedures issued earlier.

The pilot returned to the ZBW frequency, but the ZBW controller was unable to make contact. The CZUL controller was issuing vectors to the aircraft when radar and radio contact were lost. The ZBW controller attempted to reach the pilot through other aircraft but was unable to establish communications. A search and rescue was initiated within 30 min.

The NTSB determined the probable cause(s) of this accident to be:

The pilot's inadvertent encounter with icing conditions, which resulted in an aerodynamic stall and loss of control. Contributing was the pilots' inadequate preflight weather planning.

### Flying Under the Radar—Private Helicopters

by Rob Freeman, Civil Aviation Safety Inspector, Commercial Flight Standards, Standards Branch, Civil Aviation, Transport Canada

I doubt that anyone would disagree that the helicopter is a unique invention, with its ability to hover, to operate practically anywhere and to land on an unprepared surface barely larger than the machine itself. Because of these remarkable capabilities, both private individuals and commercial operators now make up the purchasers of these machines whereas, in the not-so-distant past, helicopters were almost exclusively commercially operated. Surprisingly, the regulatory differences governing these two groups are notable, even though the flying skills and environment to operate commercially or privately are the same. Whereas the commercial regulations and standards are all-encompassing, there are minimal training and checking requirements for private operators and pilots, who are expected to take the necessary steps to ensure their own competency and currency. This situation is the same for small airplanes operated under the *Canadian Aviation Regulations* (CARs).

The following extract from TSB Final Report A09Q0131, which is also summarized in Issue 1/2013 of the *Aviation Safety Letter*, illustrates this discussion. It relates to the investigation into the private sector helicopter accident which happened on August 5, 2009, in Mont Laurier, Que.

*The investigation could not determine the pilot's experience on helicopters, but according to the log book for the Enstrom, he had flown about 300 hours on C-GVQQ since purchasing it in 1986. The pilot had received two hours of training on the EN28 in July 1986 and five hours of training on the BH06 in April 2006 to qualify for endorsement on these helicopter types. The Canadian Aviation Regulations (CARs) do not require that training records be kept for pilots in private operation. As a result, the investigation could not determine whether or not the pilot received additional flight training on the EN28 since July 1986.*

### Food for thought

*While the report goes over the weather aspects in length, it does not explore the fine line of authority between the hired PIC and the owner pilot-rated passenger. Such an arrangement is actually not uncommon, but can be challenging and prone to additional stress. Even though the report states that they worked as a crew, the flight remained the sole responsibility of the PIC. A PIC flying with his or her boss as unofficial co-pilot, in the boss's own airplane, may be placed in a very uncomfortable, pressure-filled position when discussing difficult weather conditions and making the go or no-go decision. Critical decision-making comes into play, particularly on the part of the PIC, but also from the owner/passenger. This report is worth a second read-through, particularly for anyone out there who faces such a situation, either as a hired PIC, or as an aircraft owner/passenger who delegates the PIC duties to someone else. —Ed. Δ*

### Recency Requirements

*To continue exercising the privileges of his licence, a pilot must comply with the recency requirements set out in CARs. The occurrence pilot was in compliance with these requirements as follows:*

1. *he acted as pilot-in-command or co-pilot of an aircraft within the five years preceding the flight;*
2. *he successfully completed a recurrent training program within the 24 months preceding the flight.*

Unfortunately, recent trends reveal an increase in accidents involving private pilots with causal factors tied to relatively low experience levels or lack of currency. This results in inadequate skills and poor judgment being exhibited at a critical moment—either during the flight planning decision to go, or in the air when things go wrong.

Commercial operators have some advantage here; the normal practice is to oversee the low-time pilots and to restrict the flights they are allowed to make. As a former chief pilot, I screened all flights made by our low-time pilots to protect them, our clients and our own safety record. No pilot was assigned to a job when there was any question of their currency, validity or competency. Unfortunately, there is no equivalent safety net for a private pilot who decides to take off after dusk without a night rating, or make a grand entrance and land in the parking lot at a busy restaurant or at a friend's cottage.

Some related accident reports reveal poor decision making—flights into bad weather including forecast icing, night flights without a night rating or mandatory equipment installed, and/or failure to initiate the proper emergency procedure when problems do occur.



Wreckage of private Enstrom F-28C helicopter

One example: Two private pilots in separate incidents attempted to fly back to their aerodromes of departure after mechanical problems (engine backfiring and losing power) became evident, rather than initiating immediate emergency landings. When the rotor rpm decays, ground contact, with or without pilot input, is imminent. In these cases, neither pilot was successful in their bid to continue flying, and the resulting accidents were much more severe because control of the aircraft was ultimately lost.

For those who fly infrequently or have relatively low time in type, here are a few hard facts arising from various TSB reports to (re)consider:

- Most light helicopters are approved for day/night VFR only. That is because they do not have the natural stability to be flown on instruments without the addition of an autopilot and have no icing protection for the main or tail rotor. Any icing on the rotors can quickly become unmanageable. As well—heads up!—night flight over unlit areas, which includes most of Canada, is essentially instrument flight. The aircraft itself may be certified, but a very dark night with no discernible horizon can be as terrifying and deadly as inadvertent instrument flight in cloud or fog. Disorientation may occur as soon as the first turn away from the airport or ground lighting when the world suddenly goes black.
- **Solution:** If the forecast weather or time of day does not permit you to remain within the helicopter's certification limitations, your own abilities or your licence privileges—do not go. This requires the use of **sound judgment** and **decision-making skills**.

- Unlike light airplanes where the engine-fuselage forward weight bias may permit a stall recovery as the nose naturally drops (altitude permitting), a helicopter main rotor that fully stalls following an engine failure will not unstall and will not respond to control inputs. In helicopters with low inertia rotors (which includes most recent models), an unrecoverable main rotor stall can develop one second or so after engine failure. You must reduce collective to the minimum within that narrow time frame and enter autorotation to preserve rotor rpm and avoid a loss of control crash.
- **Question:** Are you current with your helicopter's autorotational procedures and confident in your own abilities if the engine quits? Important considerations include optimum speeds, limitations, glide distances and flare height. This requires **regular training and practice, in order to maintain flying skills**.

- Helicopters require considerable technique to land in a small clearing, in the mountains or other areas where the available power and lift may be reduced by density altitude and/or strong down-flowing winds. The main and tail rotors of current aircraft are of a light but strong construction which does not tolerate any surface contact. Clipping a tree or rock—even slightly—with the main rotor or tail rotor may result in a complete loss of control. Precision hovering skills are critical in these scenarios to avoid collisions or rollovers.

- **Caution:** Before you commit the aircraft to a landing at altitude or in a confined area, be aware that once you commit, you may not have enough power to abort or escape if things go wrong. Do you know how to calculate your aircraft's performance to ensure a safe power margin for the intended operation? This requires **judgment** and **skill**.

You can argue that these same accidents commonly occur in the commercial sector. That is true. Unfortunately, they are more likely to occur and with more severe consequences if the pilot has relatively low experience, limited training or lapsed currency. Flying a light helicopter requires numerous skills that degrade unless structured training and emergency procedures are practiced on a regular basis. These skills are perishable and degrade more quickly in helicopters because of the number and complexity of helicopter-specific emergencies that can occur and escalate in flight.

### Canadian registered private helicopters - accidents and accident rates 2008–2012

	2008	2009	2010	2011	2012
Canadian registered private helicopter accidents <sup>1</sup>	9	8	2	9	12
Canadian civil aircraft registered private helicopters <sup>2</sup>	741	809	851	866	880
Accident rates per 1 000 Canadian private helicopters	12.1	9.9	2.4	10.4	13.6

Accident average over 5 years equals 9.68 or approximately 10 per year.

### Canadian registered commercial helicopters - accidents and accident rates 2008–2012

	2008	2009	2010	2011	2012
Canadian registered commercial helicopter accidents (703) <sup>1</sup>	15	7	14	10	6
Canadian civil aircraft registered commercial helicopters <sup>2</sup>	1696	1701	1739	1790	1829
Accident rates per 1 000 Canadian commercial helicopters	8.8	4.1	8.1	5.6	3.3

Accident rate average over 5 years equals 5.82 or approximately 6 per year.

- For the last 5 years, private pilots in helicopters have been involved in 40% more accidents per thousand on average than comparable commercial pilots operating under CARs Subpart 703.

<sup>1</sup>Source: Transport Canada, adapted from Transportation Safety Board, preliminary data as of July 25, 2013.


<sup>2</sup>Source: Transport Canada, Canadian Aviation Register.

After conducting many check rides over the years, I've found that most commercial pilots with recent training and currency fly their helicopters competently and safely. From personal observation, there are two areas that seem to be consistently problematic:

- Non-compliance with the rotorcraft flight manual limitations because of lack of knowledge;
- Lack of ability or familiarity with the aircraft handling procedures, particularly when demonstrating emergencies.

Both result from a lack of proper training or practice. Given the referenced accident reports, they are the same safety issues a low-time private pilot should be concerned with. The remedy is simple enough: Find a qualified person who is willing to give instruction in your helicopter or in the same model (hopefully one that is similarly equipped), with emphasis on crew resource management (what used to be called airmanship), decision-making, systems knowledge and abnormal/emergency procedures in particular. Some commercial operators, training institutions and manufacturers offer training packages tailored to their client's needs. A quick evaluation ride and a few targeted questions will establish a baseline and identify what training needs to be accomplished.

Training is not cheap, but what value do you place on your own life or that of your passengers? If you are not undergoing recurrent training **at least once a year**, you may not have the skills, knowledge or judgment to respond correctly when things go wrong. The bottom line is that helicopters are more complex and demanding to fly than light airplanes and those specialized skills have a *best before* date. Going extended periods without flying a helicopter and without recurrent training is the thread that connects many of these private sector accidents.

In addition to the 2009 Mont Laurier occurrence linked earlier (A09Q0131), the following three links to other private helicopter accidents also illustrate these issues and may be of interest: TSB Final Report A09Q0210, TSB Final Report A05P0154 and TSB Final Report A09C0207. 

## Carburetor Icing Likely Cause of Downed Piston Helicopter

*The following article is based on TSB Final Report A11O0222—Collision with Terrain and is presented to highlight the hazard of carburetor icing in piston-engine helicopters.*

### Summary

On November 28, 2011, a Robinson R22 helicopter departed the Region of Waterloo International Airport (CYKF), Ont., for a local training flight with a student and instructor on board. The preflight inspection, start-up and engine run-up were completed near the company's hangar and the crew air taxied the R22 to a grassy departure area south of the approach path to Runway 08. There was a short delay due to tower frequency congestion. During this 5-min time period,

the crew decided to practice touchdowns and lift-offs from the hover. At 11:30 EST, the air traffic controller cleared the crew to lift off and make a turn around the control tower for a southbound departure. Approximately 1 min after takeoff, the helicopter crashed in a drainage swamp on airport property, fatally injuring the instructor and seriously injuring the student. The helicopter was destroyed by impact forces; there was no post-impact fire.



### Accident sequence

The aircraft lifted off from the grassy area with the student pilot in control and proceeded as instructed by the air traffic controller. After reaching approximately 200 ft AGL, at a typical departure speed, southbound over an area of multiple hangars and overhead wires, the instructor instructed the student to apply carburetor heat. It is not clear whether this instruction was actioned; however, shortly thereafter, the engine shuddered, the engine rpm decreased, and the instructor assumed control. The helicopter yawed first to the left then back to the right and began to descend. At 11:31 EST, the R22 impacted the ground in a level pitch attitude with little forward velocity.

The crash site was a 4-ft deep drainage swamp on the airport's southern perimeter, approximately 60 ft short of an open

field. The helicopter was destroyed. The instructor was fatally injured by the vertical impact force, and the student was seriously injured.

### Other information

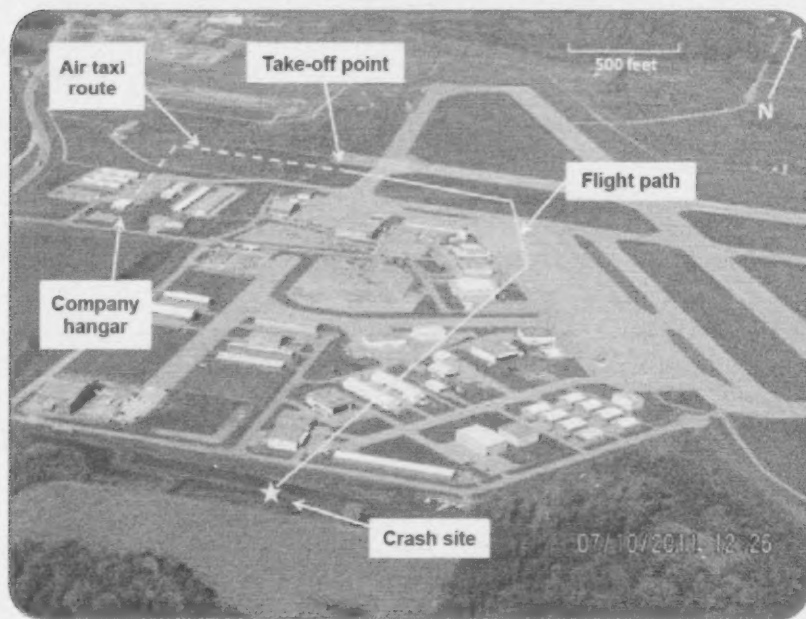
The weather was appropriate for VFR flight. The wind was light and variable, the visibility was greater than 9 SM, the ceiling was overcast at 1 300 ft AGL, the temperature was 4°C and the dew point was 1°C. It had rained most of the previous day and at the time of the occurrence, the ground, including the grassy area, was very wet.

The instructor was licensed and qualified in accordance with existing regulations. In addition to the required training, a Robinson Helicopter Company Pilot Safety Course was completed by the instructor in December 2008, which focused on emergency procedures including autorotation. At the time of the occurrence, the instructor had approximately 1 040 total flight hr, mostly on Robinson helicopters. The instructor was off duty the preceding two days and the occurrence flight was the second flight of the day. The student pilot had approximately 18 total flight hr, the most recent flight being one week earlier.

The aircraft was equipped and maintained in accordance with existing regulations and was being operated within published weight and balance limitations. It was equipped with a Lycoming O320-B2C engine: a 4-cylinder, carbureted, normally aspirated engine producing 160 horsepower. The engine controls include a twist grip throttle, fuel mixture control, carburetor heat control and an rpm governor. The following gauges are installed to monitor

engine performance: engine and rotor dual tachometer, manifold pressure gauge, ammeter, oil pressure and temperature, and a carburetor air temperature gauge.

The fuel mixture and carburetor heat controls are located on the centre pedestal in close proximity to each other. To aid in identification, the control knobs are shaped differently. Furthermore, the fuel mixture control knob is red while the carburetor heat control knob is black (Photo 1). To prevent inadvertent deployment in flight, the manufacturer's checklist directs the pilot to place a removable cylindrical plastic guard over the mixture control knob before starting the engine (Photo 2). This guard is not to be removed until engine shutdown when the mixture control knob is pulled to the idle cut-off position (Photo 3). This plastic guard is not permanently attached to the control panel.



*Flight path*

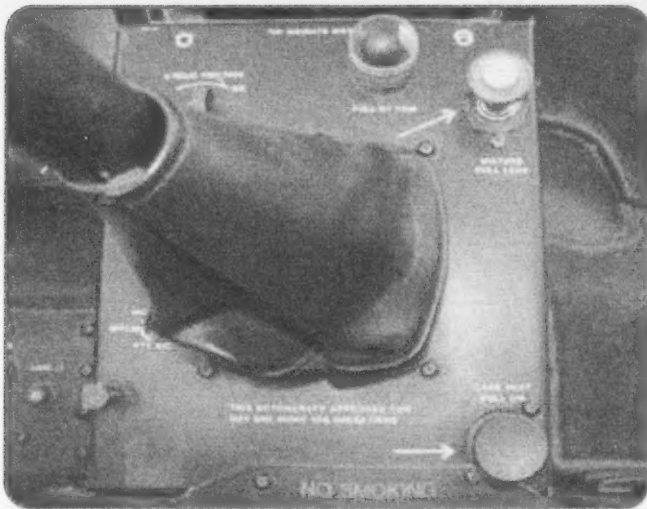


Photo 1: Mixture control top right and carburetor heat control bottom right



Photo 2: Mixture control with guard installed

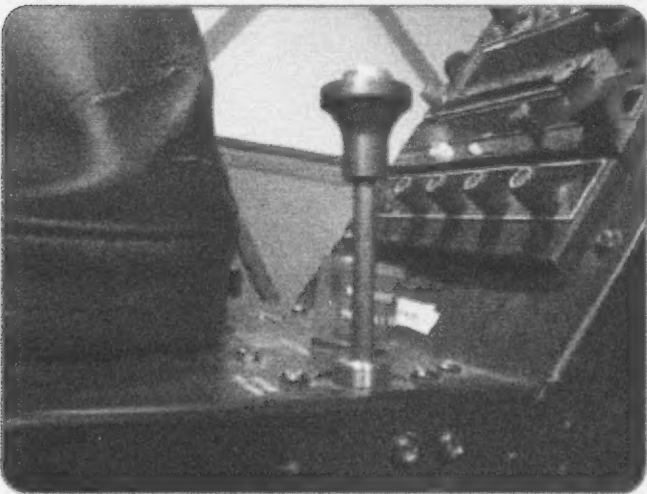


Photo 3: Mixture control in idle cut-off position

### Wreckage examination

The crash site was a drainage swamp on the airport perimeter which had thin wires strung across it in a checkerboard fashion to prevent birds from occupying it. The helicopter's position amongst the wires indicated a near vertical descent. Most of the damage and deformation to the helicopter was on the bottom surface, which is consistent with a near vertical impact with little forward velocity. One of the main rotor blades was bent in a fashion consistent with coning, which may have resulted from low rotor rpm in flight or from impact with the water. There was no evidence of rotor mast bumping or main rotor blade contact with the tail boom.

There were no pre-impact mechanical failures or system malfunctions that would have contributed to this accident. A teardown of the engine and accessory gearbox revealed that although they were serviceable, they were not turning at impact. The plastic mixture guard was not found at the crash site. The fuel mixture control was found in the full rich position. The carburetor heat control knob was found in the cold position. Examination of the cable-operated guillotine valve in the carburetor air box confirmed that the carburetor heat was selected to cold prior to impact.

### Carburetor icing

Carburetor icing is a phenomenon where the temperature of air entering the carburetor is reduced by the effect of fuel vaporization and by the decrease in air pressure caused by the Venturi effect. If water vapour in the air condenses when the carburetor temperature is at or below freezing, ice may form on internal surfaces of the carburetor, including the throttle valve. As ice forms, this increases the Venturi cooling effect due to the narrowing of the carburetor throat, and this narrowing reduces power output. Unchecked, the ice can quickly lead to a complete engine failure. To overcome carburetor icing, aircraft manufacturers provide a system to heat the incoming air and prevent ice accumulation.

Unlike piston-powered airplanes, which normally take off at full throttle, helicopters take off using only as much power as required. This partial throttle position makes them more vulnerable to carburetor ice, especially when the engine and induction system are still cold. The Robinson R22 is equipped with a throttle governor which can easily mask carburetor icing by automatically increasing the throttle to maintain engine rpm, which will also result in constant manifold pressure. To alert pilots to the possibility of carburetor ice, the helicopter is also equipped with a carburetor air temperature (CAT) gauge which displays a yellow arc outlining the range of temperatures to be avoided during possible icing conditions. Robinson R22 pilots are instructed to apply carburetor heat as required to keep the CAT out of the yellow arc during power settings above 18 in. manifold pressure and to apply full carburetor heat at settings below 18 in.

If significant ice is allowed to develop within the carburetor and full heat is applied to melt it, the resultant water flow through the engine causes the engine to run rough temporarily and to lose further power.

To help determine whether flight conditions are more or less susceptible to carburetor ice, charts based on a knowledge of dry (ambient) and wet (dew point) air temperatures have been produced. The temperature and dew point at the time of the occurrence when referenced against these charts describe the conditions as the most severe or "serious icing – any power". In addition, the likelihood of accumulating ice can be exacerbated by operations in cloud, fog, rain, areas of high humidity, or in this case, ground operations over wet surfaces, especially wet grass.

#### Low rpm rotor stall

The manufacturer notes that rotor stall due to low rpm causes a very high percentage of light helicopter accidents (refer to linked safety notices SN-10 and SN-24 in next para). This risk is greatest in small helicopters such as the R22 which have low main rotor blade inertia. When engine power is lost, the collective must be lowered immediately, which induces a rate of descent. If this rate of descent is reduced by raising the collective, the rotor rpm will be reduced. If the rpm is reduced too much, the rotor will stall and no longer provide the lift required to support the helicopter.

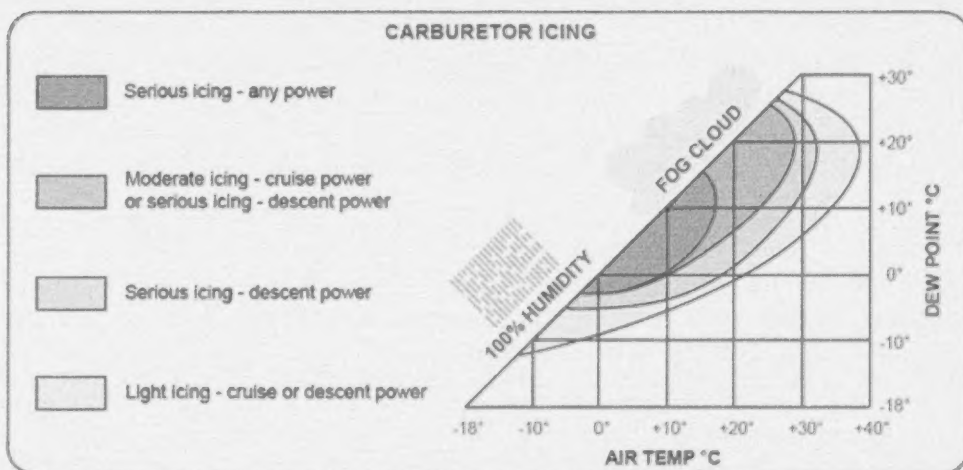
#### Robinson Helicopter Company safety notices

Following a series of accidents and incidents, the Robinson Helicopter Company issued safety notices (SN) to its operators to reduce the likelihood of similar accidents. These are published on their Web site and at the back of their pilot's operating handbook (POH). Of particular relevance are the following SNs:

- SN-01—Inadvertent Actuation of Mixture Control in Flight
- SN-10—Fatal Accidents Caused by Low RPM Rotor Stall
- SN-24—Low RPM Rotor Stall Can Be Fatal
- SN-25—Carburetor Ice
- SN-31—Governor Can Mask Carb Ice

#### Analysis

The helicopter's engine was not running at impact although there were no mechanical anomalies that would have prevented its operation.



Carburetor icing probability chart

The weather conditions at CYKF were highly conducive to carburetor icing. In addition to the temperature/dew point spread, the operation conducted over wet grass would have intensified the rate of ice accumulation.

The investigation could not determine whether the carburetor heat control was adjusted as required to keep the CAT out of the yellow arc during the period the helicopter was hovering over wet grass or during takeoff. However, when the helicopter struck the ground, the carburetor heat was selected to cold. This cold selection may have been the result of not applying carburetor heat; or if it was applied after ice had formed in the carburetor and the immediate result was a rough running engine, the carburetor heat may have been de-selected. In either case, the engine likely stopped due to ice blocking the airflow through the carburetor.

An instructor flying with a relatively new student would likely be carefully monitoring the student's actions, particularly during the critical takeoff phase. The possibility that the mixture control was inadvertently selected to idle cut-off was considered to be unlikely as the student would have had to remove the mixture guard, pull the mixture control to idle cut-off and return it to full rich without the instructor's intervention. In addition, the fact that the carburetor heat, which would have been required given the conditions, was found in the cold position would further suggest that this scenario is unlikely.

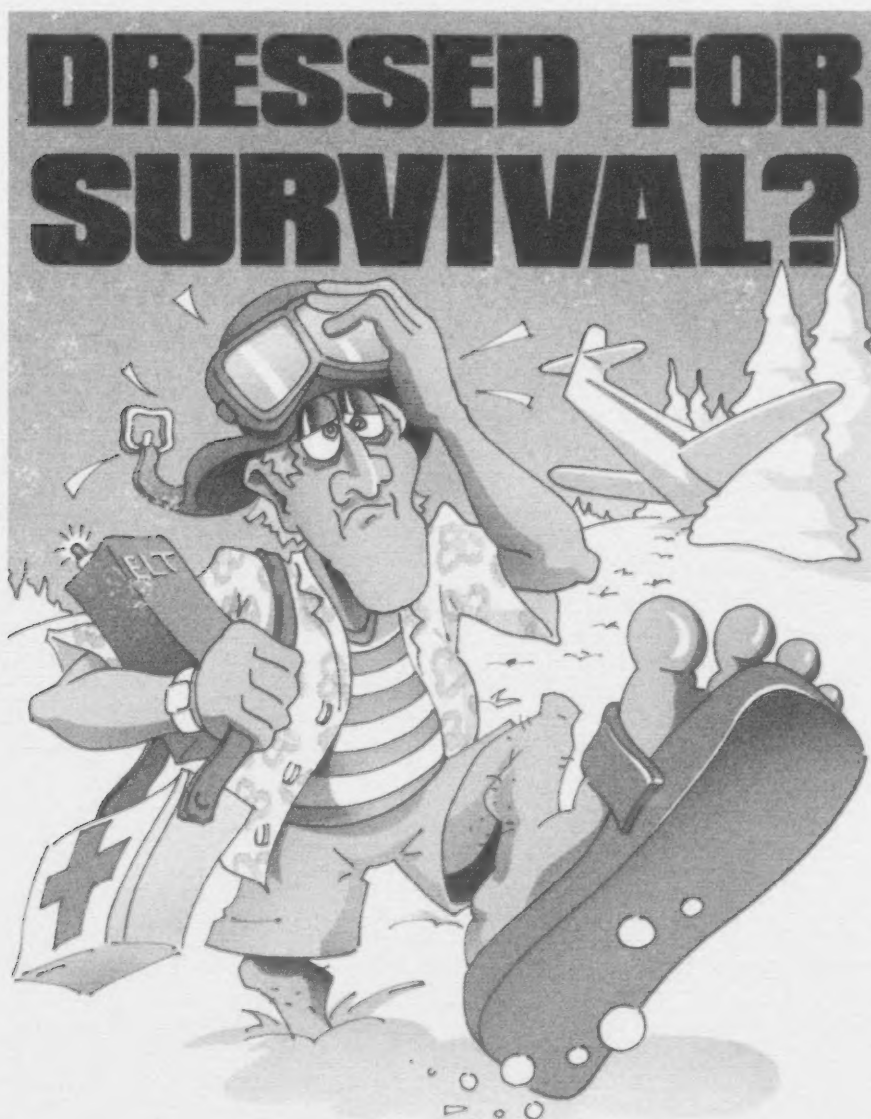
At the time the engine failed, the position of the helicopter would have made a successful autorotation very difficult; it was at low altitude over a group of hangars with multiple overhead wires strung between numerous poles. The closest spot which was free of obstacles was the field 60 ft beyond the crash location.

The quick yawing following the engine failure most likely resulted from torque changes due to power loss. This yawing would have decreased forward velocity and increased the angle of descent. In an attempt to decrease the angle of descent and reach the field, the pilot likely raised the collective causing the rotor rpm to decrease to a point which could no longer sustain flight. The helicopter subsequently fell almost vertically into the swamp area short of the field.

#### *Findings as to causes and contributing factors*

1. Environmental conditions were conducive to serious carburetor icing. It could not be determined if carburetor heat was applied.

2. The helicopter's engine failed during departure, most likely due to ice accumulation in the carburetor.
3. The departure path took the helicopter over an area of buildings and obstacles, which would have made a successful autorotation difficult.
4. The pilot likely raised the collective in an attempt to reach a suitable field, causing the rotor rpm to decay to a point which could no longer sustain flight. The helicopter subsequently fell, almost vertically, into the swamp.  $\Delta$





# MAINTENANCE AND CERTIFICATION

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## On Maintenance Errors

The following article by Joe Scoles (JS) was originally published in Issue 4/1998 of Aviation Safety Maintainer and is republished for its enduring value as a safety promotion tool.

The following is a list of eight maintenance errors compiled by Robert Sargent, a maintenance human factors engineer at the Boeing aircraft company. After reading this list, I reviewed the errors that were tabled in *Maintainer* articles back as far as 1982. As a result of my findings in these articles, I not only agree with Mr. Sargent's list, but I find very few new issues that could be added. Mr. Sargent did an excellent job in his research and he also brings to light the importance of those very simple maintenance items that cause so much trouble. Could it be that shift change and work practice often enter the picture?

1. Incorrect installation of components;
2. Electrical wiring discrepancies;
3. Inadequate lubrication;
4. Fuel or oil caps and fuel panels not secured;
5. Fitting of wrong parts;
6. Loose objects left in aircraft;
7. Access panels/fairings/cowlings not secured; and
8. Gear pins not removed before departure.

*I would like to add to this list:*

9. Pitot/static covers and/or tapes not removed after maintenance;
10. Inadequate inspection or faults missed during inspection; and
11. Work not in accord with standard or accepted practice. — JS

Although AMEs are aware of these simple human inadequacies, they still end up getting caught out on a limb occasionally. Let us imagine that typical errors are tied to a chain with a noose on the opposite end, which is looped around the neck. As you read the incident examples below, think about how the outcome might have changed if the noose tightened around the subject's neck every time he or she walked away from an aircraft when simple but important items were missed during inspection and maintenance.

**Boeing B737** — The crew declared an emergency and returned for a safe landing after the No. 1 engine failed shortly after takeoff. After landing, the crew shut down the engine and, during taxi, they observed fuel leaking from the engine cowling. Maintenance reported that the engine had spooled



down owing to a large fuel leak near the dump valve. Further examination revealed that the leak had occurred because a ferrule was missing from the coupling that secured a high pressure fuel line to the dump valve. Maintenance installed the ferrule, secured the fuel line coupling and returned the aircraft to service.

**McDonnell Douglas DC-10** — Shortly after takeoff, passengers reported fuel leaking from an outboard wing fuel panel. After verifying the report, the pilot decided to dump fuel and return to the airport. Maintenance found the source of the fuel leak to be two large screws that had been incorrectly installed in the leading edge of the wing and had punctured the fuel tank. The aircraft had been on lease to a foreign operator when the oversize screws were installed. The correct size screws were installed, the fuel tank was resealed and the aircraft was returned to service.

**Cessna A-185F** — During cruise flight, the engine (Continental IO-520-D) quit. The pilot was uninjured and the aircraft undamaged during the forced landing on a pond. Inspection of the aircraft revealed that the bolt connecting the throttle cable to the throttle had become dislodged. The report indicated that the cotter pin had failed and the nut had come off. *The report did not explain how it was determined that the cotter pin failed.* — JS

**Cessna 337** — The pilot declared to air traffic control that both engines had failed, then subsequently reported that he had restarted the engines. He landed safely at a nearby airport. Further investigation revealed that both engines were operating from one fuel tank. The gauge for this tank was indicating over half full at the time the engines stopped. An inspection revealed that the fuel tank was empty, and the fuel gauge was reading incorrectly. *The one time that a fuel gauge is supposed to be accurate is when the tank is empty.* — JS

**Cessna 172** — The aircraft departed on a local VFR training flight and, shortly after takeoff, the pilot reported a very rough running engine and returned to the airport, making a safe landing. Maintenance declared there were no discrepancies with the aircraft and it was ground run with no problems. Maintenance suspects that the fuel selector was slightly off the detent for one of the tanks and that this may have interrupted the fuel flow. Maintenance went on to state that there is some “play” in the selector switch and it is possible the selector may have been positioned incorrectly.

*From my experience with Cessna aircraft, I do not entirely agree that “play” is part of a correctly functioning and rigged fuel selector. What we seem to be discussing is excessive wear somewhere in the fuel valve control. The inexperienced student may have focused on the pointer, not realizing the selector could be off the detent. — JS*

**de Havilland DHC-8-102** — The aircraft diverted to an alternate airport because of a radar failure. Before landing, the crew reported an unusual odour in the cockpit, which may have indicated an electrical problem. Company maintenance discovered a shorted out No. 1 advisory display panel. The advisory display panel was replaced, the system checked and the aircraft returned to service.

*This raises a broader issue: did the circuit protection devices work as advertised or did the advisory display panel simply burn itself off-line? This point was not discussed in the incident report, but it is important to keep in mind whether electrical systems always function as required to cut off the flow of current when a short occurs. — JS*

I'll close with a couple of cases that reflect the old classic involving items pilots often miss during pre-flight. Maintenance people can help pilots prevent such incidents through awareness and vigilance.

**Cessna 421** — The aircraft departed Thompson, Man., on a medical transportation flight with two pilots and a flight nurse on board. Shortly after departure, the pilots noticed oil on the cowlings of the left engine. They shut it down, declared an emergency and returned to Thompson. Examination of the aircraft indicated that the oil had come from the engine oil filler, whose cap had been left unsecured after the pilots' pre-flight check.

**Cessna 310** — The aircraft departed Sioux Lookout, Ont., but declared a Mayday and returned shortly thereafter owing to an open exit door. Inspection after landing revealed that the door was not properly secured before departure.  $\Delta$

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## FAAST Tips on Maintenance—Older General Aviation Aircraft

*The Federal Aviation Administration (FAA) Safety Team (FAASTeam) publishes a very useful series of monthly maintenance tips. They include references to the FAA and other American associations such as the AOPA, EAA, etc. Given that the fabric of our own Canadian general aviation (GA) industry is inextricably tied to the American GA system and manufacturers, the tips are universal and are applicable to Canadian aircraft. Tips are not regulations or directives but serve a purpose of outreach, education and awareness. If you have any questions on the material presented below, feel free to contact us. The FAASTeam's online maintenance tips are republished with their generous permission.*

### Aging Aircraft in General Aviation (GA)—Best Practices

#### Part 1: Introduction

How often do you work on old or aging aircraft still in operation? Unfortunately, manufacturers of those aircraft may have gone out of business, and those that still exist might not be able to provide field support. Engineering drawings, maintenance procedures and technical data other than the FAA's Advisory Circular 43-13 (AC43-13) just aren't available from nonexistent manufacturers.

**Before** you work on that old aircraft, ask the owner for all the acquired, organized or preserved data about their aircraft. Reviewing this data greatly increases the likelihood of improvements in maintenance practices and safe operation of a particular aircraft. These actions can have an enormous impact on the continued airworthiness of an aging aircraft when you approve it for return to service.

Next, we will talk about two specific best practices that can have a fundamental impact on your approach to maintenance and inspection of aging aircraft. These are records research and special attention inspections relating to aging aircraft. Doing either of these helps assess the condition of an aircraft. You need both to thoroughly assess the effects of aging (corrosion, metal fatigue, inspection techniques, wiring deterioration, etc.) on an aircraft and monitor its condition during future operations.

#### Part 2: Records Research

What is your first step in determining the condition of an aging aircraft? It should be records research! The records will help you determine the degree of inspection necessary, as well as what items may have already been inspected. Your research will help to identify a particular aircraft's maintenance and usage characteristics as well as the areas of an aircraft model type or class that may require closer attention.

Inspection and overhaul recommendations contained in older GA aircraft maintenance instructions may not provide adequate guidance regarding aging issues. Therefore, assessing the quality of maintenance and inspections during an aircraft's life is important to determine which parts have been replaced, if corrosion was ever a problem and other maintenance factors that could lead to a concern with aging.

If you are going to work on an older aircraft, ask the owner for all available information so you can establish the maintenance history. Your knowledge and experience will help to reveal if there are voids or missing information. Advise the owner about these discrepancies and offer to help get the information.

You can compare research about more general model type issues with individual aircraft information to identify similarities and differences. In effect, this helps answer the question: Does the information I am seeing on this particular aircraft match the history of the aircraft records?

Once collected, the information will help you and the owner establish a baseline to determine what maintenance, repairs and alterations have been done and how well the aircraft has been cared for.

### *Part 3: Special Attention Inspections*

Your assessment of an aircraft's paperwork is only the prelude to a thorough aging evaluation. For aging aircraft, the normal annual inspection minimum requirements specified in 14 CFR 43.15 Appendix D or those recommended by the manufacturer may not be enough. You may need to do a detailed inspection, a series of inspections, modifications, part replacements or a combination of these actions to maintain airworthiness and keep an aging aircraft operating safely.

As an aircraft ages, the inspection methods and techniques may change from what was previously required. High aircraft time, severe operating environments, inactivity, outside storage, modifications or poor maintenance can all prompt a special inspection. The record research will provide information for owners and mechanics to discover what a particular aircraft or aircraft type may need.

Special inspection criteria can be written to pertain to a specific aircraft or aircraft type. In the reference listed below, you will find an "Aging Airplane Inspection and Maintenance Baseline Checklist". You can use this checklist as a starting point to develop a model- or airplane-specific inspection and maintenance checklist.

The design concepts of systems (mechanical, electrical and flight controls) and structures (layout and materials) are similar from model to model and from manufacturer to manufacturer for most aging GA aircraft. Areas typically susceptible to aging have been identified.

This concludes the GA aging aircraft series of maintenance safety tips. This should also be where you begin to modify or enhance your maintenance techniques when working on aging aircraft. We highly recommend you review the publication titled "**Best Practices Guide for Maintaining Aging General Aviation Airplanes**", which can be found at: [www.faa.gov/aircraft/air\\_cert/design\\_approvals/small\\_airplanes/cos/aging\\_aircraft/media/aging\\_aircraft\\_best\\_practices.pdf](http://www.faa.gov/aircraft/air_cert/design_approvals/small_airplanes/cos/aging_aircraft/media/aging_aircraft_best_practices.pdf)

Share the guide with your maintenance colleagues and pilot acquaintances that work on and/or fly these older aircraft. ▲

## **New Advisory Circular: Segmented Passenger Weights for Part 703 Operators**

Did you know that....

...with the coming into effect of Subsection 723.37(3) of the Commercial Air Service Standards (CASS) on July 30, 2012, weight and balance calculations for aeroplanes operating under Subpart 703 of the CARs can no longer use the standard passenger weights published in section RAC 3.5 of the Transport Canada *Aeronautical Information Manual* (TC AIM)? The amended standard calls for operators of aeroplanes under Subpart 703 of the CARs to determine the weight of passengers by using either actual weights or segmented weights (TCCA published or air operator derived), as described in Advisory Circular (AC) No. 703-004, titled "Use of Segmented Passenger Weights by Commercial Air Operators under Subpart 703 of the *Canadian Aviation Regulations*". For complete details, please consult the AC 703-004 linked above as well as section RAC 3.5 of the TC AIM.



## TSB FINAL REPORT SUMMARIES

*The following summaries are extracted from final reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include the TSB's synopsis and selected findings. Some excerpts from the analysis section may be included, where needed, to better understand the findings. For the benefit of our readers, all the occurrence titles below are now hyperlinked to the full TSB report on the TSB Web site. —Ed.*

### **TSB Final Report A10A0041—Loss of Control and Collision with Terrain**

On April 23, 2010, a Grumman TBM-3E fire-fighting aircraft departed Miramichi Airport, N.B., for a practice water drop flight at about 13:38 ADT. Approximately 2 min later, the aircraft collided with terrain just south of the airport. Emergency responders and workers from nearby businesses responded immediately. The aircraft was destroyed by the impact forces. There was no reported emergency locator transmitter signal. Medical examination determined that the pilot had suffered a heart attack prior to the aircraft impacting the ground. *The TSB authorized the release of this report on July 4, 2011.*



*TBM firefighting aircraft*

#### *Analysis*

Nothing was found to indicate that there was any airframe failure or system malfunction prior to or during the flight. It was also determined that the weather conditions did not play a role in this occurrence. The autopsy determined that the pilot had suffered a heart attack, resulting in the aircraft departing controlled flight and the impact with the ground. Therefore, the analysis will focus on the medical aspects of the investigation.

The pilot's medical status was being followed by a family physician who originally diagnosed the pilot with hypertension in 1998. The pilot was taking medication to treat this condition. However, this information was not recorded on the Canadian Aviation Medical Examination Report (CAMER) until 2008 because the pilot had not

disclosed this information to the Civil Aviation Medical Examiner (CAME) and the family physician had not reported the relevant condition to Transport Canada (TC). Present regulations provide the CAME with the authority and the means to obtain any additional medical information necessary to determine if a pilot meets the medical requirements of their licence. However, if there is no basis to do so because a pilot has not disclosed a symptom/condition to their CAME, an additional medical investigation is not conducted. Non-disclosure of medical symptoms/conditions to a CAME negates some of the safety benefit of examinations and increases the risk that pilots will be allowed to fly with a medical condition that poses a risk to safety.

In addition, although the family physician was aware that the pilot held a pilot's licence, there was a lack of awareness of the requirement to report to TC any medical conditions that may affect flight safety. This is consistent with the results of the TSB's discussions with other CAMEs and personal physicians. There may be a lack of awareness amongst Canadian general practitioners of the requirement to report medical conditions that may affect flight safety. This may result in a CAME not having all the information required to accurately determine a pilot's fitness for flight.

The guidelines contained in TP 13312 state that if the 10-year risk score, determined by using the risk scoring system (RSS), is 20% or greater, a cardiovascular assessment should be carried out. When using the RSS, an applicant's 10-year risk score can only be accurately determined if their cholesterol test results are known. However, a cholesterol test is not a required test under current standards; therefore, test results are only provided voluntarily, if known. Because CARs Standard 424 does not require an applicant to provide the results of a cholesterol test, there is a risk that CAMEs may not have all of the information needed to accurately determine an applicant's 10-year risk of a cardiovascular event.

Use of the RSS and the pilot's cholesterol results indicated a medium 16% risk score, which did not require further assessment. Had the pilot reported his elevated fasting blood sugar and serum triglyceride levels to the CAME, current Canadian medical protocol would have suggested a reassessment of the pilot's risk factor profile and additional tests in order to further ascertain his state of health. Additional tests, such as an exercise treadmill test, would likely have

provided indications of the underlying heart disease. Despite multiple cardiac risk factors, the Canadian Aviation Medicine (CAM) system in aggregate (i.e. the pilot, the family physician, the CAME and the Regional Aviation Medical Officer [RAMO]) did not identify the pilot's underlying coronary disease.

In this case, neither the CAME nor the RAMO used the check boxes on the medical form or the RSS contained in the guidelines to consolidate and assess the applicant's risk level. Since TC's guidelines reference the RSS, it would be reasonable to expect that the TC medical examination report form would include a table consistent with what is published in the guidelines and that the guidelines would provide clear direction on its use. Because the CAMER form does not include the RSS table, there is a risk that cardiovascular risk factor information will not be recorded or used effectively when determining an applicant's risk of a cardiovascular event. The risk is exacerbated because the guidelines do not provide clear direction on the use of the table.

A full risk profile of this pilot would have included his age, obesity, BMI, smoking habits, hypertension, elevated triglycerides and blood sugar, as well as prompted further investigations to detect underlying coronary disease. These comprehensive investigations would likely have identified him as high risk for a cardiovascular event.

#### *Findings as to causes and contributing factors*

1. The pilot's underlying coronary disease was not identified despite the defences built into the Civil Aviation Medicine system.
2. The aircraft departed controlled flight and impacted terrain because the pilot suffered a heart attack.

#### *Findings as to risk*

1. A lack of awareness amongst Canadian general practitioners of the requirement to report medical conditions that may affect flight safety may result in TC not having all the information required to accurately determine a pilot's fitness for flight.
2. Non-disclosure of medical symptoms/conditions to a CAME negates the safety benefits of the examination and increases the risk that a pilot will fly with a medical condition that poses a risk to safety.
3. TC guidelines for CAMEs do not adequately assess and document all cardiovascular risk factors in pilots, thereby increasing the probability that these risks will go undetected.
4. When pilots do not wear their safety harnesses, they are at greater risk of injury during operation of the aircraft.

## **TSB Final Report A10H0004— Runway Overrun**

**Note:** *The TSB investigation into this occurrence resulted in a significant report, with extensive discussion and analysis on many issues such as aircraft tires, brakes, braking coefficient, precipitation, runway end safety area, runway maintenance, runway surface texture, runway surface condition, runway slope, grooving of runways, wet runway operations, hydroplaning and more. We have published the report's summary, findings as to causes and contributing factors, and selected safety actions. Readers are invited to read the full report, hyperlinked in the title above. —Ed.*

On June 16, 2010, an Embraer EMB-145LR, from Washington Dulles International Airport, landed at 14:30 EDT on Runway 07 at Ottawa/MacDonald-Cartier International Airport and overran the runway. The aircraft came to rest 550 ft off the end of Runway 07 and 220 ft to the left of the runway centreline. The nose and cockpit area were damaged when the nose wheel collapsed. There were 33 passengers and 3 crew members aboard. Two of the flight crew and one passenger sustained minor injuries. *The TSB authorized the release of this report on April 17, 2013.*

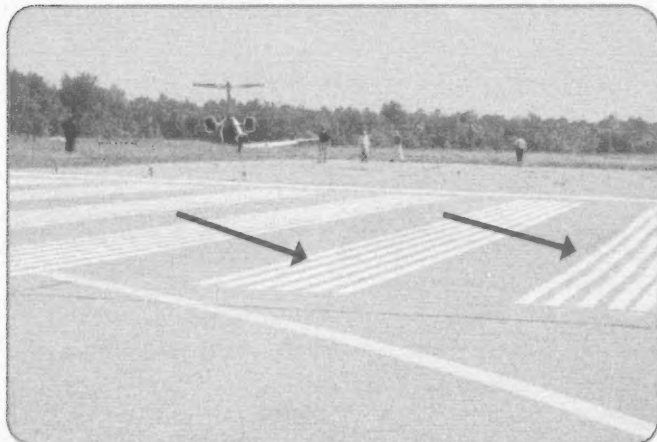


*The EMB-145LR following the occurrence*

#### *Findings as to causes and contributing factors*

1. The crew calculated an inaccurate  $V_{APP}$  (i.e., target approach speed) and flew the approach faster than recommended.
2. The aircraft crossed the threshold 8 kt above  $V_{REF}$  (i.e., threshold crossing speed), resulting in an extended flare to a touchdown of 2 270 ft, which was 770 ft beyond the operator's desired touchdown point of 800 to 1 500 ft, but within the first third of the available landing distance as per the operator's standard operating procedures (SOP).

3. The smooth landing on a wet runway led to viscous hydroplaning, which resulted in poor braking action and reduced aircraft deceleration, contributing to the runway overrun.
4. Rainwater accumulated on Runway 07/25 due to the crosswind and the design of its transverse slope, resulting in a further decline in the coefficient of friction for the occurrence flight.
5. The crew did not select flaps 45, as encouraged by the operator's SOP, for landing on a wet, ungrooved runway, which resulted in a higher landing speed and a longer landing distance.
6. The crew did not initiate a go-around when  $V_{REF}$  was exceeded by more than 5 kt indicated airspeed.
7. The antiskid brake system operated as designed, by keeping the brake pressures from rising to commanded values after brake application in order to prevent the wheels from locking. With little braking action during the landing roll, the aircraft overran the runway.
8. The aircraft overran the runway threshold and the runway strip and subsequently encountered a significant dip, where the nose landing gear folded rearward, resulting in substantial damage to the nose of the aircraft.



Steam cleaned marks observed on the departure end of Runway 07

### Safety action taken

#### Transportation Safety Board of Canada (TSB)

On March 2, 2011, the TSB sent an Aviation Safety Advisory to the Ottawa International Airport Authority, designating CYOW Runway 07/25 as "slippery when wet." This letter contained a review of the friction-testing requirements and the subsequent action required if the readings fall below prescribed limits. Also mentioned was the airport's requirement to provide a runway that is "so constructed as to provide good friction characteristics when the runway is wet." This requirement would include a proper profile of the runway to ensure "the most rapid drainage of water." A review of the profile

of Runway 07/25 with respect to transverse slope revealed that this runway did not meet the minimum recommended practices of 1% specified in TP 312. The advisory concluded with a suggestion that the Ottawa International Airport Authority may wish to review its operational procedures, in conjunction with guidance contained in TP 312, and consider designating Runway 07/25 as being "slippery when wet."

#### Ottawa International Airport Authority

The Ottawa International Airport Authority conducted friction testing in April 2011. Although the testing showed friction values above the level at which corrective action would be required, some values along Runway 07/25 fell to a level at which maintenance action would be required. Pending rubber removal from Runway 07/25, planned for May 2011, the Ottawa International Airport Authority sent a NOTAM indicating that Runway 07/25 may be slippery when wet. This NOTAM was set to expire on June 15, 2011. The Ottawa International Airport Authority has been conducting friction testing on a monthly basis since April 2011. This testing included not only the TP 312 requirement for wetting the runway to a depth of 0.5 mm, but also completed tests using the international standard of 1 mm. Additionally, testing was completed during actual rainfall conditions. Based on the significantly higher friction levels achieved after rubber removal, the NOTAM was cancelled. Rubber removal was also conducted twice during this period. In October 2011, a Skidabrader was used to increase the friction levels of both Runway 07/25 and Runway 14/32.

In 2012, the Ottawa International Airport Authority resurfaced Runway 07/25 and corrected the runway camber and transverse slope. At the same time, taking into account the recommended practices of ICAO, it built a 300-m runway end safety area (RESA) at each end and was the first airport in Canada to do so.

#### Environment Canada

Environment Canada has published the *Manual of Surface Weather Observations (MANOBS)*, 7<sup>th</sup> edition, Amendment 18, effective January 2013. MANOBS Section 10.3.5.6(c) has been amended to require reporting of changes in precipitation intensity criteria for issuing a SPECI (e.g., LGT [light] to MDT [moderate] or HVY [heavy]; MDT or HVY to LGT; MDT to HVY; or HVY to MDT).

#### Transport Canada

Transport Canada has published Advisory Circular No. 300-008: Runway Grooving, effective April 8, 2013. The purpose of the document is to provide information and guidance regarding the grooving of runway pavement.

## TSB Final Report A1000125—Stall and Spin and Collision with Terrain

On June 20, 2010, a Cessna 172K was returning to Toronto/ Buttonville Municipal Airport after an aerial advertising and banner-towing flight. It flew a low approach parallel to Runway 33, dropped the banner in the grass and commenced an overshoot for landing on Runway 33. Shortly thereafter, the aircraft stalled and spun to the ground. The pilot was fatally injured and the aircraft was destroyed by the impact and a post-crash fire. The emergency locator transmitter functioned until it was consumed by fire. The accident occurred at 17:28 EDT. *The TSB authorized the release of this report on April 13, 2011.*



### Analysis

Airport operations, ATC services and weather did not contribute to this accident. There was no indication of any difficulty in handling the aircraft with the banner in tow and it disengaged cleanly.

Records indicate that the aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures. There was no communication from the pilot indicating any difficulty. The pilot was certified and qualified for the flight in accordance with existing regulations. Fatigue was not considered a contributing factor.

In attempting to find a reasonable explanation as to why the aircraft stalled and spun to the ground, a number of plausible scenarios were considered:

- the controls were fouled or jammed;
- the aircraft was improperly configured;
- the pilot became incapacitated or otherwise unable to control the aircraft;
- the pilot's seat was not locked in position and slid on the rail;
- the pilot attempted an emergency return to the runway; or
- the pilot induced the pitch-up for some other reason.

The control cables were found intact and control surfaces were free to move. Aircraft manoeuvres throughout the low approach, banner drop and initial overshoot were all normal. Nothing was found to indicate that the controls were fouled or jammed in such a way to induce an abrupt pitch-up or prevent recovery.

The flaps were up and the pitch trim was found in the neutral position, a normal position for takeoff consistent with the banner drop sequence and subsequent climb at normal climb airspeed. In this configuration, in the absence of any pilot input, the aircraft could not autonomously achieve the pitch attitude or angle-of-attack that occurred in this accident.

If not properly secured, the seats of some aircraft, including Cessna types, have been known to slide backwards unintentionally on their rails. This may be due to acceleration forces on the initial takeoff or the pilot pushing on the controls to counter the trim change when power is applied on a go-around in the flap-down configuration. There is no known instance of seats sliding back in Cessna aircraft equipped with the 2007 secondary seat stop. Impact and fire damage made it impossible to determine with certainty whether or not the seat had been properly locked in position before impact or to determine its position at impact.

The investigation considered the possibility of an engine failure or other malfunction that would have led the pilot to attempt an immediate return to the field. It was determined that the propeller was turning at impact but not at full power. Examination of the engine, its components and ancillary controls did not reveal any anomalies that would have precluded normal operation. An engine failure from fuel starvation due to the non-standard selection of the right tank was considered unlikely.

On the go-around, the aircraft was to the left of the runway. Had the aircraft experienced an engine power loss, it is doubtful that the pilot would have turned to the left, away from the field; the more logical action would have been to turn right. Moreover, having been trained at Buttonville, in the event of an emergency landing, the pilot would likely have been aware of suitable landing sites in the vicinity of the departure area of Runway 33.

After dropping the banner, the pilot may have attempted to check the drop area by looking through the rear window. This would require pitching up deliberately and twisting the torso. With the left hand on the yoke and the right hand on the throttle, the twisting motion could have induced an inadvertent reduction in power and downward pressure on the left side of the yoke, resulting in a left bank. It is unclear how this would have resulted in a sustained power reduction and sustained application of aft elevator without the pilot taking notice and making corrections.

None of these scenarios could be validated.

### *Findings as to causes and contributing factors*

1. For undetermined reasons, during an intentional overshoot, the aircraft climbed, pitched up steeply, stalled and entered a spin from which it did not recover.
2. The impact was not survivable.

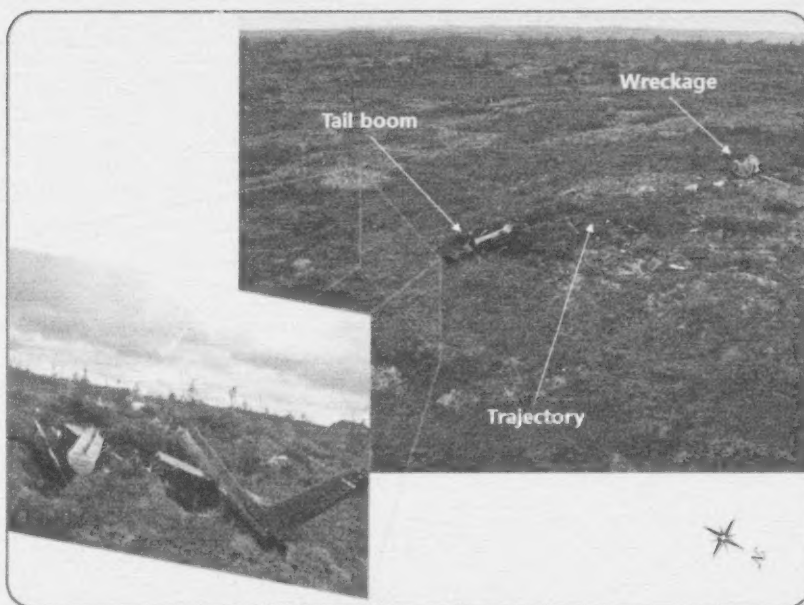
### **TSB Final Report A10Q0132— Loss of Visual Reference with the Ground, Loss of Control, Collision with Terrain**

**Note:** *The TSB investigation into this occurrence resulted in a significant report, with extensive discussion and analysis on many issues such as pilot experience, weight and balance, weather, company management, regulatory oversight, spatial disorientation, pilot decision-making, pressures and more. Therefore we could only publish the summary, findings and safety action in the ASL. Readers are invited to read the full report, hyperlinked in the title above. —Ed.*

On August 17, 2010, at 11:11 EDT, a Eurocopter AS350-BA helicopter departed from Sept-Îles, Que., under VFR for Poste Montagnais, Que., approximately 100 NM north of Sept-Îles. Fifty min after takeoff, the company's flight-following system indicated that the helicopter was 22 NM north of Sept-Îles and was not moving. A search was conducted and the wreckage was found on a plateau. There was no fire but the aircraft had been destroyed on impact. The pilot and the 3 passengers on board were fatally injured. No distress signal was received from the emergency locator transmitter (ELT). *The TSB authorized the release of this report on January 23, 2013.*

### *Findings as to causes and contributing factors*

1. For unknown reasons, the pilot did not take the fork in the Nipissis River but eventually had to turn back because of the clouds covering the terrain. This extension of the flight reduced the amount of fuel available to reach the destination.
2. The pilot had reduced the fuel load to accommodate the large amount of baggage, thus decreasing flight endurance in the event of unforeseen circumstances. This decreased endurance is what probably prompted the pilot to take a shortcut towards the mountains in order to return to the original flight route.
3. The pilot continued the flight in conditions that were below VFR weather minima specified in the *Canadian Aviation Regulations* (CARs), thus increasing the risk of losing visual reference with the ground.



*Photographs of accident site showing helicopter wreckage and breakup trajectory*

4. While the aircraft was flying in marginal weather conditions above the plateau, the pilot lost visual contact with the ground and then control of the aircraft, causing it to crash into the ground.

### *Findings as to risk*

1. When a large client charters a helicopter for a flight that cannot be carried out in compliance with the CARs, and the carrier agrees, the pilot is subject to tacit pressure to take off with an overloaded aircraft.
2. When a large client's passengers show up with excess baggage, they exert implicit pressure that could lead the carrier and pilot to allow an overloaded flight.
3. When baggage is not weighed, the takeoff weight cannot be accurately calculated, and the helicopter may take off with weight in excess of the maximum allowable, thus increasing the risk of an accident due to overload.
4. When inexperienced pilots face operational pressures alone without support from the company, they can be influenced to make decisions that place them and their passengers at risk.
5. Transport Canada exercises little regulatory oversight of helicopter operations on the ground, and load details are not recorded in the logbooks. Consequently, there is no way of knowing whether a flight is overloaded on takeoff.
6. Although the ELT emitted a signal, it was not picked up by the international satellite system for search and rescue (COSPAS-SARSAT) because the ELT's antenna was severed. This may have delayed search and rescue efforts, affecting the survival of the occupants.

7. Commercial helicopter pilots do not routinely practise instrument flying or regaining control of a helicopter with an unusual attitude solely with reference to the flight instruments. They are therefore at greater risk of losing aircraft control if they lose visual contact with the ground.

#### *Other finding*

1. Programs for passenger awareness of flight conditions permitted by regulation may encourage passengers to question the pilot's decision to continue a VFR flight below the weather limits prescribed by regulation.

#### *Safety action taken*

##### **Operator**

The operator has taken the following remedial action since the accident on August 17, 2010.

- The maintenance manager, avionics technician and a specialized firm are working on a Limited Supplemental Type Certificate (LSTC) to equip the entire fleet with digital flight instruments (Horizon and DG), which are more reliable than mechanical ones.
- Additional management staff have been hired to increase pilot supervision.
- A safety system manager position that does not report to the operations manager has been created.
- Initial training of newly certified pilots is now much more extensive and involves 20 to 25 hr of dual instrument instruction.
- Training on the ground and in flight has been introduced to reduce the risks of flying in bad weather.
- An 8-hr decision-making and controlled flight into terrain (CFIT) avoidance course has been developed and is being delivered by an experienced pilot.
- The operator is building an outdoor scale on the tarmac to check the real weight of goods loaded.
- Every aircraft is now equipped with a portable hanging scale.
- Personal scales are also available to pilots who ask for them.
- Repeated requests have been made to the Société de protection des forêts contre le feu (SOPFEU) and to Hydro-Québec to install permanent scales at their bases of operations.
- When accepting a charter request, the operator now tries to ascertain the client's real needs in order to recommend the appropriate helicopter.
- Various weight and balance calculation tools are now available to pilots, e.g., an Excel spreadsheet and reimbursement for the purchase of iBal and Appventive (weight and balance apps).

- Surprise audits are conducted to ensure pilots complete and respect the weight and balance forms and fly according to company standards.

#### **Hydro-Québec**

- November 10, 2010: Hydro-Québec increased surveillance and validation of hours of flying experience as well as the training program for helicopter pilots used in Hydro-Québec charter flights.
- November 25, 2010: at the annual meeting of the Association québécoise du transport aérien (AQTA), Hydro-Québec presented its employee awareness program, "La sécurité aérienne passe par le respect de certaines limites" [Air safety comes with compliance], and announced changes to its contractual requirements in order to secure the commitment of its helicopter providers to address concerns raised by incidents in 2010:
  - Flight in bad weather (VFR limit)
  - Takeoff with an overloaded aircraft (weight limit in the aircraft manual)
  - Flight within the height-velocity curve (altitude-speed)
  - Flight within less than 11 m of power lines and communication towers
- January 2011: Hydro-Québec added an air safety component (respect of operational limits) to its helicopter provider evaluations.
- April 2011: Hydro-Québec launched its employee awareness program. More than 20 sessions have been held so far for key user groups.
- January 2012: Hydro-Québec added unannounced audits to its helicopter provider evaluations, particularly at job sites serviced by charters, to ensure, among other things, that loads do not exceed aircraft weight limits. Hydro-Québec now also requires its providers to implement a safety management system (SMS).
- June 2012: Hydro-Québec launched its field surveillance program with surprise audits of charter flights and with a focus on specific issues of concern.
- Certain clauses in contracts have been amended to ensure that weight and balance forms are completed for all flights conducted for Hydro-Québec. This aspect is checked during the unannounced audits.

#### **TSB Final Report A11C0152— Freewheel-Assembly Malfunction During Practice Autorotation Landing**

On September 13, 2011, a Bell 206B helicopter was on a local training flight at Thunder Bay International Airport, with a student pilot and instructor on board. The crew were using the threshold of Runway 30 as a designated landing area. At approximately 16:30 EDT, the student pilot entered

a practice 180° autorotation to a planned power recovery. When the student initiated the power recovery, the rotor rpm decreased. The instructor took control and completed an autorotation. The low-rotor warning horn activated and remained on during the autorotation. The helicopter landed firmly yet not hard enough to activate the emergency locator transmitter. The rotor then struck the tail boom and the mast separated just below the rotor head. The helicopter was then shut down and the crew exited without injuries. There was no fire. The accident occurred during day visual meteorological conditions. *The TSB authorized the release of this report on December 12, 2012.*



*Mast and pitch links*

### *Analysis*

The crew responded decisively to an emergency, at a critical stage of flight in close proximity to the ground, and performed a successful autorotation landing. Neither environmental nor operational factors contributed to the occurrence. The analysis will address technical aspects relating to the helicopter's drivetrain.

Bell Helicopter Technical Bulletin 206-79-31 introduces a filter at the transmission oil outlet intended to prevent contamination of the restrictor. Although the filter was

originally introduced to prevent particles of cut O-rings from contaminating the restrictor, it is likely that the filter would also be effective protection from other types of debris. This bulletin was optional and had not been incorporated, which increased the risk of restrictor contamination. The resulting reduction of oil flow may result in freewheel-assembly damage.

Since the installation of the freewheel assembly in March 2004, the aircraft had a relatively low annual utilization rate, averaging approximately 145 hr per year interspersed with periods of inactivity. Chapter 10 of the *Bell Standard Practices Manual* provides storage and reactivation procedures for aircraft preservation. However, there was no indication that these procedures were applied. The internal corrosion of the transmission oil cooler union, tube and freewheel assembly components predated the accident and indicated that water had been present in the transmission oil system. The transmission, oil cooler and piping had been installed in February 2002. Between then and March 2004, the aircraft flew approximately 722 hr, so it is likely that the corrosion developed later. The investigation could not determine the source of the water contamination. It is likely that condensation introduced moisture into the transmission and freewheel oil system during periods of inactivity. The presence of moisture in the oil system would have led to corrosion in the freewheel assembly and transmission oil cooler fittings. This was indicated by the iron oxide paste that coated the internal components of the freewheel, the pitting of the sprag surfaces, and the corrosion of the aluminum inlet union and magnesium outlet pipe attached to the transmission oil cooler. The pressure oil supply from the main rotor transmission to the freewheel assembly was reduced by a blockage at the restrictor (P/N 206-040-254-001) consisting of aluminum and magnesium corrosion products released from the transmission oil cooler union and pipe. The oil flow to the freewheel assembly was severely reduced. Operation without adequate lubrication resulted in damage and overheating of the already corroded internal components.

The freewheel assembly did not engage as the throttle was rolled on during a power recovery autorotation. As the helicopter was leveled with aft cyclic input, the rotor rpm began to decrease even though the engine began to spool up. The engine test runs indicated that an N1 rpm of 75% (12% above idle) was sufficient to accelerate an unloaded N2 gear train to approximately 104% N2 rpm. The rotor rpm decay indicates that the engine power was not being transmitted to the rotor system. When the sprag clutch suddenly engaged, the inertia built up in the N2 gear train was resisted by the mass of the decelerating main rotor, which resulted in the overstress failure of the mast. The acceleration of the lower portion of the mast instantly caused the pitch links to contact the swash plate drive link and break the collar set away from the mast. The swash plate outer ring was pulled

around by the main rotor via the pitch links until the drive link rotated down and jammed against the inner (fixed) swash plate ring. The main rotor continued to decelerate and the pitch links wound around the spinning lower mast and pulled the main rotor blades to a nearly 90° negative pitch before failing in tension. As the main rotor came to a stop it flapped to one side and a blade bumped into the tail boom. The metal particles found in the transmission lower mast bearing support area were generated by the lower mast abrading against the upper mast stub. The lower mast came to a stop when the crew shut down the engine.

#### *Findings as to causes and contributing factors*

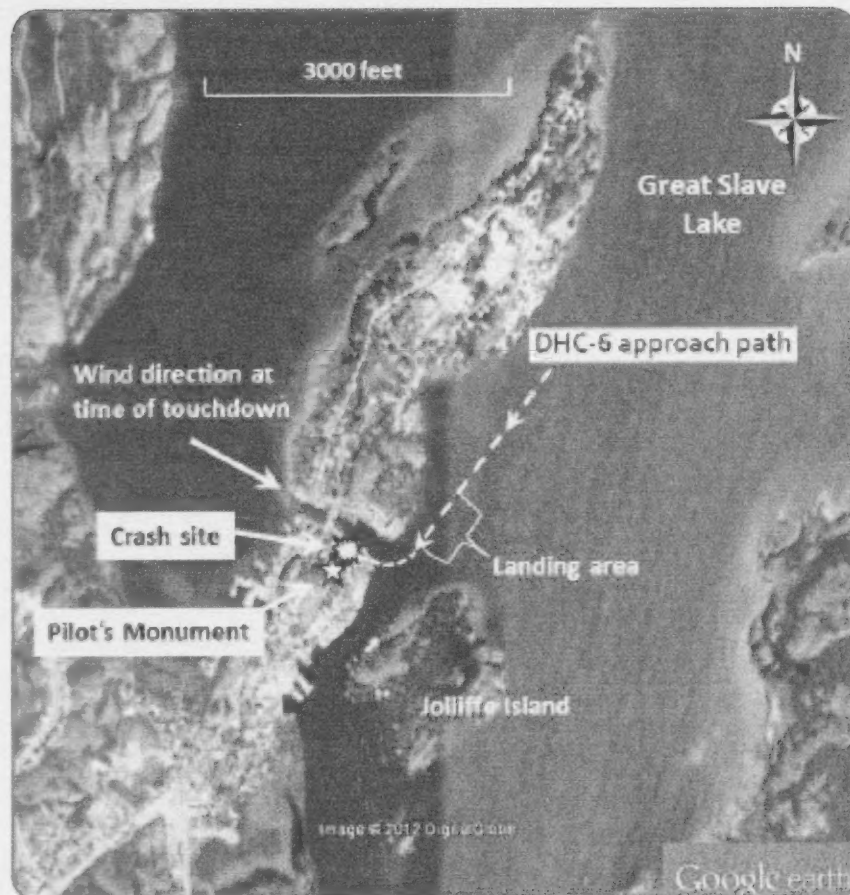
1. At some point, moisture had entered the transmission oil causing contamination and corrosion of the internal components of the freewheel assembly and oil system.
2. Blockage of the restrictor fitting in the oil supply line by corrosion products resulted in reduced oil flow.
3. Operation of the freewheel assembly without adequate lubrication resulted in damage and overheating which impaired its proper functioning.
4. When the damaged freewheel assembly did not engage, engine power was not transmitted to the rotor drive train during an attempted power recovery autorotation.
5. After touchdown, the freewheel engaged and the resultant torque spike severed the main rotor mast and caused torsional damage to the entire drivetrain.

#### *Findings as to risk*

1. If optional Bell Helicopter Technical Bulletin 206-79-31 is not incorporated, there is a risk that the restrictor may become contaminated. The resulting reduction of oil flow may result in freewheel assembly damage.
2. If the procedures contained in Chapter 10 of the *Bell Standard Practices Manual* are not followed, there is a risk that corrosion may develop in aircraft components during periods of inactivity.

### **TSB Final Report A11W0144—Loss of Control and Collision with Building**

On September 22, 2011, a float-equipped de Havilland DHC-6-300 Twin Otter was landing at the floatplane base (CEN9) located in Yellowknife, N.W.T., along the western



*Yellowknife floatplane base*

shore of Great Slave Lake and beside the area known as Old Town. There were 2 crew members and 7 passengers on board; the first officer (FO) was the pilot flying. On touchdown, the aircraft bounced, porpoised and landed hard on the right float. The flight crew initiated a go-around; the aircraft lifted off at low speed in a nose-high, right-wing-low attitude and continued in a right turn towards the shore. As the turn continued, the aircraft's right wing contacted power lines and cables before the float bottoms impacted the side of an office building. The aircraft then dropped to the ground on its nose and cartwheeled into an adjacent parking lot. Both crew members were fatally injured, 4 passengers were seriously injured and 3 passengers sustained minor injuries. The aircraft was substantially damaged. The 406 megahertz emergency locator transmitter activated. There was no fire. The accident occurred at 13:18 MDT. *The TSB authorized the release of this report on December 12, 2012.*

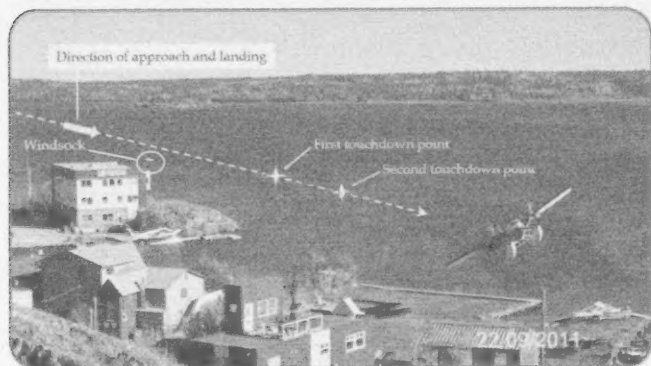
#### *Analysis*

There was no indication that an aircraft system malfunction contributed to this occurrence. The analysis will focus on crew coordination and handling of the aircraft during the landing and attempted go-around.

When the crew briefed the approach, they were aware of the strong southerly winds and of the resulting rollers. To compensate for wind conditions, an approach speed above 80 kt was agreed upon, which is 10 kt above normal approach speed with full flaps. Airspeeds prior to touchdown were at or below 80 kt, as indicated by the captain's two warnings. Strong westerly winds just prior to touchdown created crosswind and wind shear conditions over the intended landing area; these conditions were probably aggravated by the turbulence around The Rock<sup>1</sup> immediately upwind of the touchdown zone. This combination would have resulted in airspeed fluctuations and caused the initial hard landing and bounce as the FO flared for the landing.

After the initial bounce, the aircraft would have been in a slow flight condition. The strong right crosswind and pilot aileron compensation likely caused the right float to contact the water before the left float during the second touchdown. The aircraft then yawed to the right, and the nose pitched down. Aft elevator control was used to counter the nose-down movement and to initiate the go-around. This, combined with the pitch-up effect of adding full power, resulted in the aircraft lifting off the water in a very nose-high, right-wing-low attitude. With full flaps selected and both wings in a stalled or semi-stalled condition, the aircraft could not accelerate or climb for the remainder of the flight. Since the captain assumed control without declaring that he had control, it is possible that both pilots were manipulating the controls during the go-around.

Causing or allowing the nose to continue to pitch up when full power was added during the go-around meant that the airspeed could not increase. This resulted in the wings stalling and a loss of control.



*DHC-6 over docks during overshoot*

### **Findings as to causes and contributing factors**

1. Airspeed fluctuations at touchdown coupled with gusty wind conditions caused a bounced landing.
- 1 Southwest of the landing zone and the accident site in Old Town is a rock outcrop known as The Rock, rising about 70 ft above the lake and about 60 ft above the street. Located on top of The Rock is a public viewpoint, a private weather station, and the Pilot's Monument. The aircraft was photographed from the public viewpoint throughout the approach, landing, overshoot and impact with the building.

2. Improper go-around techniques during the recovery from the bounced landing resulted in a loss of control.
3. It is possible that confused crew coordination during the attempted go-around contributed to the loss of control.

### **TSB Final Report A10W0155—Loss of Control and Collision with Terrain**

On September 24, 2010, a privately operated Cirrus SR22 was on a round robin, VFR flight from Calgary/Springbank Airport (CYBW), Alta., to the area of Sundre, Alta., with three persons on board. About 5 NM northwest of Sundre, the aircraft entered a steep turning descent from about 1 600 ft AGL, striking the ground in a field at 13:47 MDT. The aircraft was destroyed by impact forces and a severe post-impact fire. No emergency locator transmitter (ELT) signal was received. The three occupants were fatally injured. *The TSB authorized the release of this report on November 24, 2011.*



### **History of flight**

The aircraft departed CYBW at 13:19 for a planned 1.5 hr flight. The aircraft travelled northwest toward Sundre Airport (CFN7), 40 NM north of Springbank, at a maximum altitude of 6 500 ft ASL and a maximum ground speed of 160 kt.

The aircraft overflew CFN7 and conducted a right hand circuit, followed by a touch-and-go landing on Runway 32 at 13:41. After the touch-and-go, as the aircraft crossed the departure end of the runway, it oscillated slightly in the pitch axis.

The aircraft then climbed to approximately 5 600 ft ASL, on a north-westerly heading, between 105 kt and 109 kt indicated airspeed (KIAS). At 13:43:50, the aircraft turned left to a heading varying between 220° and 227° magnetic (M). The aircraft maintained a relatively stable attitude with the bank angle varying between 5° left and right, and a pitch angle of approximately 5° nose up. At 13:44:21, the aircraft began to pitch to a maximum of 15° nose up, with

no increase in either vertical speed or normal acceleration, and gradually descended to 5 500 ft ASL or 1 650 ft AGL. During this time, the airspeed gradually decreased from 130 KIAS to 67 KIAS.

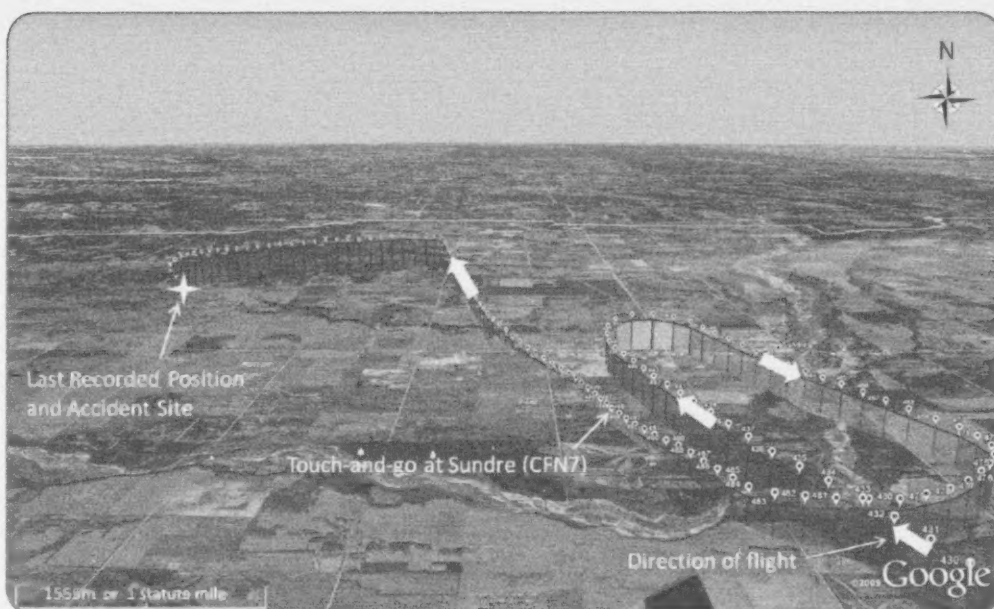
At 13:45:35, the aircraft entered a right turn which increased in rate to a maximum of  $11^\circ/\text{s}$ . Airspeed increased to 98 KIAS, accompanied by an  $80^\circ$  nose-down pitch and a rapidly increasing rate of descent. Characteristics of this turn were consistent with the early stages of a spin. When the turn reached  $329^\circ \text{ M}$  at 1 100 ft AGL, the aircraft rolled to the left. At 13:45:48, the onboard recording quality was compromised due to extreme attitudes, resulting in loss of valid pitch and roll information.

At that time, the heading was decreasing to  $120^\circ \text{ M}$ , airspeed was at 103 KIAS and the vertical descent rate was over 5 000 ft per min (fpm) with a positive loading in the vertical axis of 2.4 g. At 13:45:51, the last recorded data showed the aircraft 160 ft laterally from the impact point, with airspeed increasing through 132 KIAS, vertical descent rate increasing through 6 900 fpm and vertical acceleration reaching approximately 3.5 g. The engine was running throughout the descent to the ground.

#### *Pilot and passenger history*

The pilot-in-command, who occupied the left front seat, was issued a private pilot license in early 2005. He held a valid group 3 instrument rating, as well as multi-engine and night ratings. The pilot had accumulated about 567 hr total time, with 448 hr on the SR22. Prior to taking delivery of the SR22 in 2005, he was enrolled in an SR22 transition training program which normally consists of 7-10 hr of ground instruction and 10-15 hr of flight instruction. After 5.5 hr of ground instruction and 3.9 hr of flight instruction, weather conditions precluded completion of the training. He subsequently received at least 50 hr of dual instruction on his aircraft and later flew with the instructor for about 150 hr to improve his skills and remain current. The pilot was characterized as competent and cautious in his approach to flying.

The other two occupants were pilots who had purchased the occurrence aircraft on the morning of the accident.



*Map of the last nine minutes of flight*

One occupant had held a private pilot license for fixed wing aircraft since 1985 and a glider pilot license since 1984. His total flight time in powered aircraft was about 165 hr, but with no hours in the SR22. The second occupant was a student pilot on fixed-wing aircraft. He had completed most of the private pilot training program with 63 flying hr total flight time. His experience in the SR22 was limited to a 2 hr flight accompanying the owner from Springbank to Edmonton and back and a 1 hr familiarization flight with an instructor at Springbank. It was not determined which occupant sat in the right front seat on the accident flight.



*Cockpit and flight controls of an SR22*

#### *Flight controls*

The SR22 is equipped with dual controls, consisting of a single yoke handle protruding from the left and right sides

of the instrument panel. Pitch control is accomplished by pushing and pulling the yoke in and out of the panel. For aileron roll control, the handle is rolled laterally from side to side. Spring forces in the system centralize the yoke in the neutral position in pitch and roll and compensate for increased feedback forces to the pilot as airspeed increases. The control principles are similar to most other light general aviation aircraft. However, some differences in the action and feedback forces usually require a short adjustment period for new pilots.

### *Analysis*

The deceleration of the SR22, after the turn to the southwest, accompanied by a slight descent, is consistent with the engine operating at a reduced power setting and with the pilot attempting to maintain a more or less constant altitude. The slight loss of altitude and variation in heading suggests that the autopilot was disengaged.

The airspeed deteriorated to the point of aerodynamic stall, which was followed by entry to a spin to the right with a heading change of 90°. The aircraft behaviour in the continued descent indicates an over-recovery into a spiral dive in the opposite direction which featured rapid rotation, speed build-up and increasing positive vertical g loading. Insufficient altitude remained for recovery. The debris field and ground scars indicate that most of the rotation was stopped and a pull-up had begun immediately before the aircraft struck the ground at high speed in a nose down, slight left wing down attitude.

### *Aircraft handling by a passenger/pilot*

With nearly 500 hr on the SR22, the pilot in the left seat, who is considered to be the pilot-in-command, would have been familiar with the handling characteristics and operation of the SR22. The passengers, who were also pilots, were relatively unfamiliar with the aircraft control and display systems and had little or no experience in flying from the right seat. Since the style and placement of the side-stick flight control and flight instruments were different from what either of the prospective owners were accustomed to, maintaining precise control of the aircraft from the right seat would have presented a challenge. Since the purpose of the flight was likely to familiarize the new owners with their aircraft, it is reasonable to assume that the right seat occupant was allowed to manipulate the flight controls. The behaviour of the aircraft during the departure from the touch-and-go at CFN7 was consistent with a pilot experiencing difficulty in maintaining precise control in the pitch axis. This would suggest that one of the purchasers, occupying the right seat, was in control at the time. The gradual deceleration while maintaining a constant altitude is consistent with engaging in slow flight. With the airspeed deteriorating to stall speed,

mishandling of the controls could result in a wing dropping and a departure from controlled flight.

### *Non-deployment of the CAPS*

Early recognition of situations justifying the activation and subsequent use of the Cirrus Airframe Parachute System (CAPS) has been very effective in reducing the severity of injuries and damage to aircraft. When the aircraft entered the initial spin at least 1 600 ft AGL, there was adequate height for a successful deployment as demonstrated by Cirrus research and past occurrences. In this occurrence, the condition of the T-handle retention bracket, combined with the location and condition of the deployed parachute in the wreckage, indicates that the system did not activate until ground impact. It could not be determined why the system was not activated.

### *Findings as to causes and contributing factors*

1. For undetermined reasons, the aircraft decelerated to the point of aerodynamic stall, followed by entry into a spin.
2. The aircraft recovered from the initial spin entry and entered a spiral dive from which recovery was not accomplished before ground impact.
3. For undetermined reasons, CAPS was not activated after the aircraft departed controlled flight.

### *Finding as to risk*

1. The listing of airworthiness directives (ADs) in the Transport Canada Continuing Airworthiness Web Information System for Canadian-registered SR22 aircraft contained incomplete service bulletin references and was incomplete in listing ADs applicable to the SR22. Although it was not the official source of ADs lists, there was a potential of misleading owners with regard to current maintenance requirements.

### *Other findings*

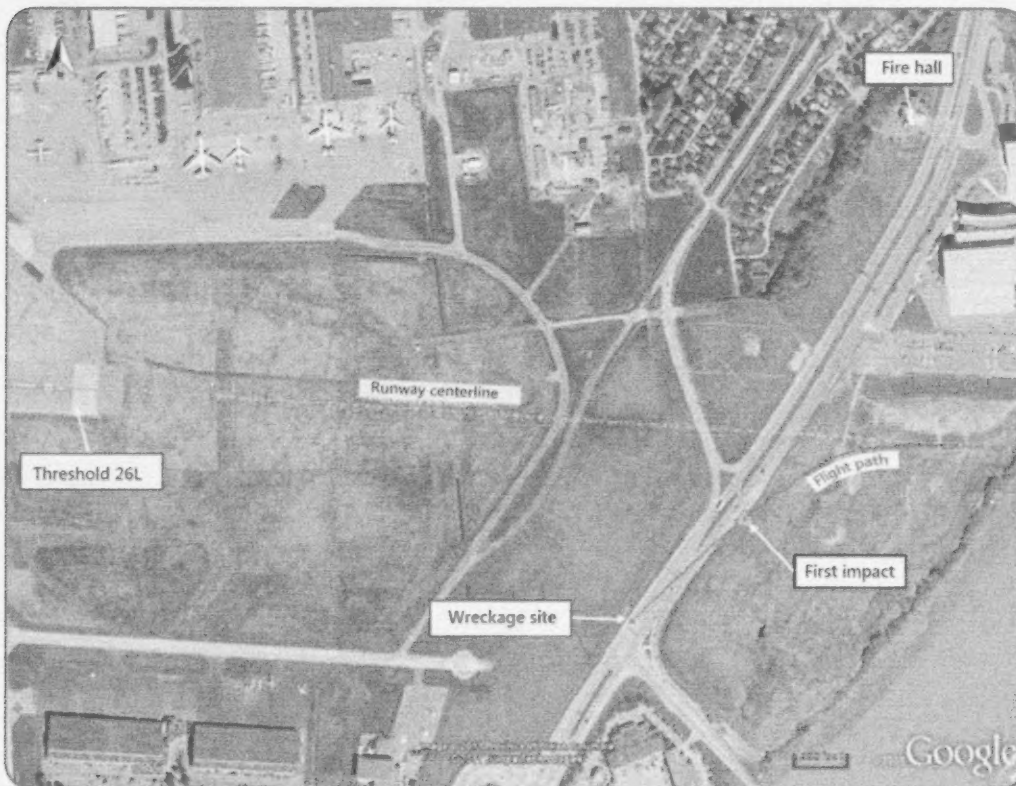
1. The occurrence aircraft was recently flown under IFR and in transponder airspace with incomplete maintenance actions.
2. An AD which applied to flight controls was not complied with in the occurrence aircraft. Although this was not shown to have had a bearing on the accident, safety was not assured.
3. It could not be determined who was flying the aircraft at the time of the loss of control.

### *Safety action taken*

After this occurrence, Transport Canada revised the listing of ADs for the SR20/SR22 and referenced Cirrus Service Bulletins to accurately reflect the current information contained in the Continuing Airworthiness Web Information System.

## TSB Final Report A11P0149—Loss of Control and Collision with Ground

On October 27, 2011, a Beechcraft King Air 100 departed Vancouver International Airport for Kelowna, B.C., with 7 passengers and 2 pilots on board. About 15 min after takeoff, the flight diverted back to Vancouver because of an oil leak. No emergency was declared. At 16:11 PDT, when the aircraft was about 300 ft AGL and about 0.5 SM from the runway, it suddenly banked left and pitched nose-down. The aircraft collided with the ground and caught fire before coming to rest on a roadway just outside of the airport fence. Passersby helped evacuate 6 passengers; fire and rescue personnel rescued the remaining passenger and the pilots. The aircraft was destroyed, and all of the passengers were seriously injured. Both pilots succumbed to their injuries in hospital. The aircraft's emergency locator transmitter had been removed. *The TSB authorized the release of this report on April 17, 2013.*



Enlarged diagram of final flight path

### Sequence of events

The aircraft had been in the hangar overnight, where it was inspected by the operator's maintenance personnel. A litre of oil was added to the left engine, and all items of the inspection were signed off as complete.

The captain came into the hangar at about 14:20, spent approximately 2 min at the aircraft and then pulled the aircraft out of the hangar, where it was fuelled. The first

officer (FO) joined the captain outside of the hangar while the aircraft was being fuelled. A complete preflight inspection of the aircraft was not conducted.

The aircraft's engines were started, and the aircraft was taxied to pick up the passengers. During the loading of the passengers, a small puddle of oil under the left engine was pointed out to the pilots. The captain acknowledged the oil, but no further action was taken. The FO carried out the passenger briefing, which included a demonstration of the main door operation. The aircraft departed the fixed-based operator (FBO) at about 15:35.

The aircraft departed CYVR at 15:41, on an IFR flight to Kelowna, B.C. The captain was the pilot flying. The flight was uneventful during its departure and climb to about 16 000 ft ASL. Approximately 15 min into the flight, the crew identified an oil problem. Oil was leaking from the left engine. The FO contacted ATC and received a clearance to return to CYVR. The captain initiated a turn toward CYVR and reduced the power for the descent. About 5 min after the turnaround, the abnormal checklist for low oil pressure was consulted.

The pilots decided that the approach would be flown normally, unless the oil pressure dropped below 40 lbs/sq. in., at which time they would follow the emergency checklist and single engine procedures. These procedures include a 10-kt addition to the  $V_{REF}$  speed and feathering the propeller.

The crew received a visual approach clearance to Runway 26L via interception of the localizer. At about 7 NM from the

runway and 1 500 ft ASL, ATC queried the crew about the need for emergency equipment. The crew declined the equipment and reported that everything was good for the moment. At 3.8 NM, with the runway in sight, the crew was cleared to land.

The flight was conducted without incident during the initial approach. Standard calls were made, which included the  $V_{REF}$  speed of 99 kt. At 3 NM from the touchdown zone, the flaps were lowered to 30%. That was followed by the lowering of

the landing gear to the down-and-locked position. From approximately 45 s before the upset, the crew's activity increased. The flaps were lowered to 60%. The ground proximity warning system (GPWS) announced the AGL altitude in ft as "500." The speed was announced as "105 kt," then " $V_{REF}$ " (99 kt), and finally " $V_{REF}$  minus 5." There was a change in the propeller noise and an immediate aircraft upset. The aircraft yawed left, rolled about 80° left and pitched nose-down about 50°. As the aircraft dove toward the ground, the wings returned to a level attitude and the nose came up, reducing the pitch to 30° nose-down. By that time, the aircraft had collided with the ground.

### Asymmetrical thrust

On twin-engine aircraft where both engines turn clockwise, such as the Beechcraft King Air 100, the left engine is considered critical; this refers to the engine whose failure would most adversely affect the performance or handling qualities of an aircraft. When an engine becomes inoperative, a yaw effect will develop. The yaw effect varies with the lateral distance from the aircraft's centreline to the thrust vector of the operating engine. This effect is amplified by the thrust produced by the operating engine. Due to the P-factor<sup>2</sup>, the right engine develops its thrust vector further away from the aircraft's centreline than does the left engine. The failure of the left engine will result in a larger yaw effect from the operating right engine.

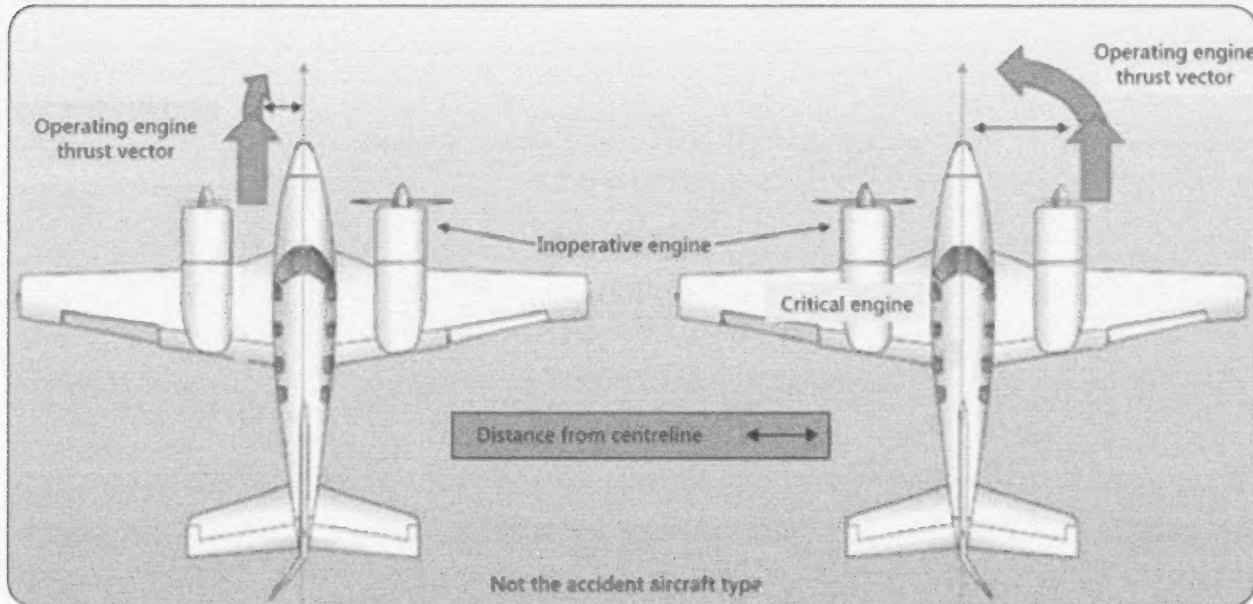
### Single-engine control

When thrust from engines off the centreline of an aircraft differs, control of yaw relies primarily on the tail's vertical stabilizer and rudder and, to a lesser extent, the ailerons. The effectiveness of these surfaces increases with speed.

Most multi-engine, fixed-wing aircraft have a minimum control speed (VMC), which is the minimum speed at which the aircraft is directionally controllable with the critical engine inoperative. Below VMC, a pilot may not be able to control the aircraft. VMC for the accident aircraft was 85 kt, based on the inoperative engine propeller windmilling, a 5° bank toward the operating engine, takeoff power on the operating engine, retracted landing gear, flaps in the takeoff position and a most aft centre of gravity.

Information on the minimum speed at which directional control can be maintained with propellers not feathered and at normal rpm is not normally provided to flight crews. However, the propeller manufacturer calculated the drag produced by the aircraft's 4-blade propeller, turning at about 1 900 rpm, to be about 300 lbs.

The application of asymmetrical thrust at low airspeed with both engines operating can result in a loss of directional control.



Source: *Airplane Flying Handbook*, FAA-H-8083-3A [US Government Printing Office, Washington DC: 2004], page 12–28. Modifications by TSB.

<sup>2</sup> P-factor is an aerodynamic phenomenon experienced by a moving propeller that is responsible for asymmetrical relocation of the propeller's centre of thrust when an aircraft is at a high angle of attack.

In August 2012, AvioConsult, an experimental flight test expert, published a review of the FAA *Airplane Flying Handbook* (FAA-H-8083-3A) with recommendations for improvement.

The review specifically refers to “Chapter 12—Transition to Multiengine Airplanes” and recommends including more comprehensive information to ensure understanding of the aspects of asymmetrical thrust that can lead to a loss of control. Canadian publications also lack this valuable information.

### *Aerodynamic stall*

An aerodynamic stall occurs when the angle of attack of a wing exceeds the critical angle at which the airflow begins to separate. When a wing stalls, the airflow breaks away from the upper surface; the amount of lift will be reduced to below that needed to support the weight of the aircraft. While stalls occur at a particular angle of attack, they can happen at a variety of airspeeds. However, those airspeeds can be estimated for given conditions.

Information from ATC radar and the cockpit voice recorder (CVR) indicated that the aircraft was about 20 kt above stall speed, which was about 72 kt for the load factors present. Also, because the upset came with an apparent power increase, it was determined that a stall was not the initiating event.

### *Findings as to causes and contributing factors*

1. During routine aircraft maintenance, it is likely that the left engine oil reservoir cap was left unsecured.
2. There was no complete preflight inspection of the aircraft, resulting in the unsecured engine oil reservoir cap not being detected, and the left engine venting significant oil during operation.
3. A non-mandatory modification, designed to limit oil loss when the engine oil cap is left unsecured, had not been made to the engines.
4. Oil that leaked from the left engine while the aircraft was repositioned was pointed out to the crew, who did not determine its source before the flight's departure.
5. On final approach, the aircraft slowed to below  $V_{REF}$  speed. When power was applied, likely only to the right engine, the aircraft speed was below that required to maintain directional control; it yawed, rolled left and pitched down.
6. A partially effective recovery was likely initiated by reducing the right engine's power; however, there was insufficient altitude to complete the recovery, and the aircraft collided with the ground.
7. Impact damage compromised the fuel system. Ignition sources, resulting from metal friction and possibly from the aircraft's electrical system, started fires.

8. The damaged electrical system remained powered by the battery; this resulted in arcing that may have ignited fires, including in the cockpit area.
9. Impact-related injuries sustained by the pilots and most of the passengers limited their ability to extricate themselves from the aircraft.

### *Findings as to risk*

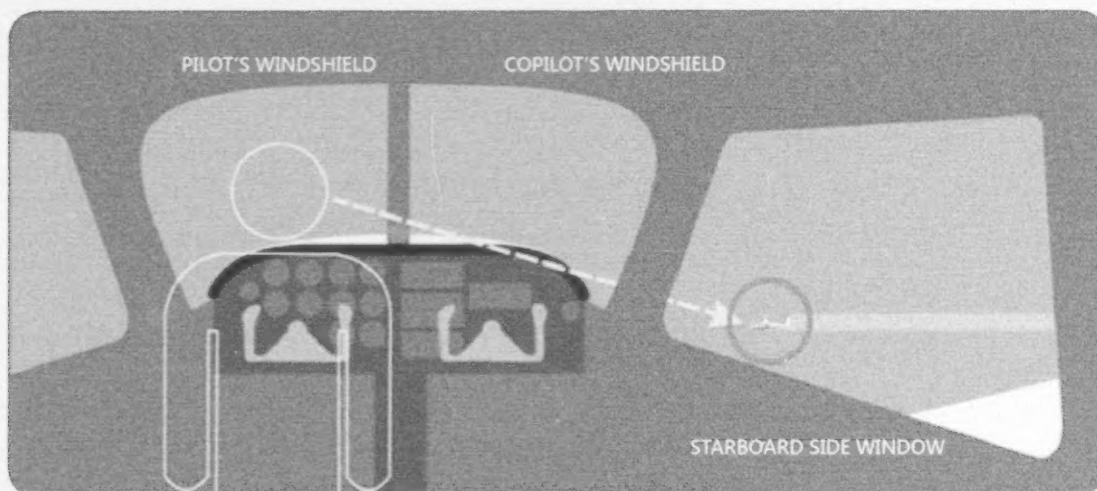
1. Multi-engine aircraft flight manuals and training programs do not include cautions and minimum control speeds for use of asymmetrical thrust in situations when an engine is at low power or the propeller is not feathered. There is a risk that pilots will not anticipate aircraft behaviour when using asymmetrical thrust near or below unpublished critical speeds and will lose control of the aircraft.
2. The company's standard operating procedures lacked clear directions for how the aircraft was to be configured for the last 500 ft, or what to do if an approach is still unstable when 500 ft is reached, specifically in an abnormal situation. There is a demonstrated risk of accidents occurring as a result of unstabilized approaches below 500 ft AGL.
3. Without isolation of the aircraft batteries following aircraft damage, there is a risk that an energized battery may ignite fires by electrical arcing.
4. Erroneous data used for weight-and-balance calculations can cause crews to inadvertently fly aircraft outside of the allowable centre-of-gravity envelope.

## **TSB Final Report A12C0053— Mid-Air Collision**

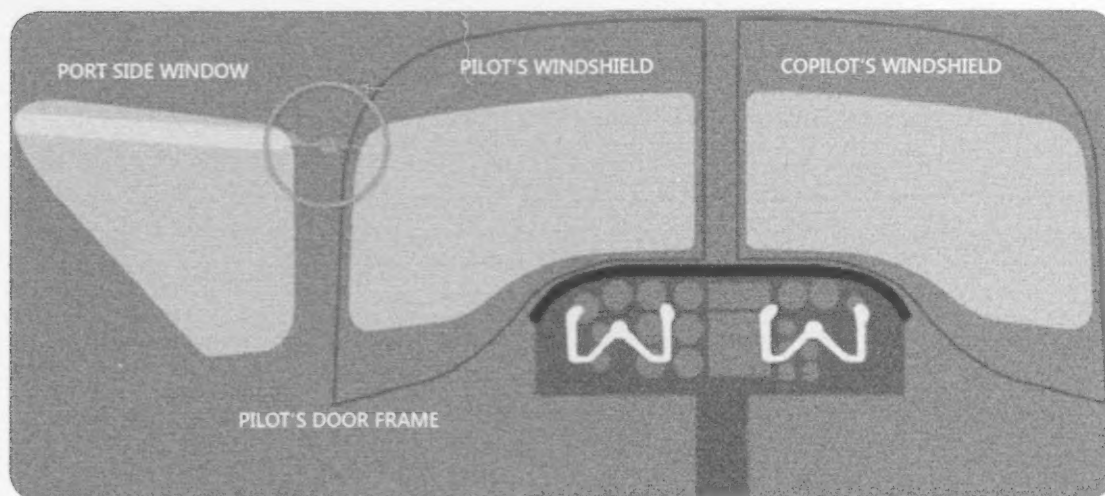
On May 12, 2012, a privately registered Piper PA-28R-200 Arrow was approaching St. Brieux, Sask., on a flight from Nanton, Alta., with the pilot and 2 passengers on board. A privately registered Lake LA-4-200 Buccaneer amphibian was en route from Regina to La Ronge, Sask., with the pilot and 1 passenger on board. At approximately 08:41 CST, the two aircraft collided about 8 NM west of St. Brieux and fell to the ground at two main sites about 0.5 NM apart. Both aircraft, which were being operated in accordance with VFR, were destroyed and there were no survivors. There was no post-crash fire and the emergency locator transmitters did not activate. *The TSB authorized the release of this report on June 11, 2013.*

### *Analysis*

There is no indication that either an aircraft malfunction or the weather contributed to this occurrence. In this occurrence, the two aircraft were following intersecting tracks. Consequently, there was a risk that they could arrive at the same point in space at the same time. The PA-28 began



*View from cockpit of the PA-28 indicating pilot's view partly obstructed by nose of aircraft  
(Note: Image not to scale.)*



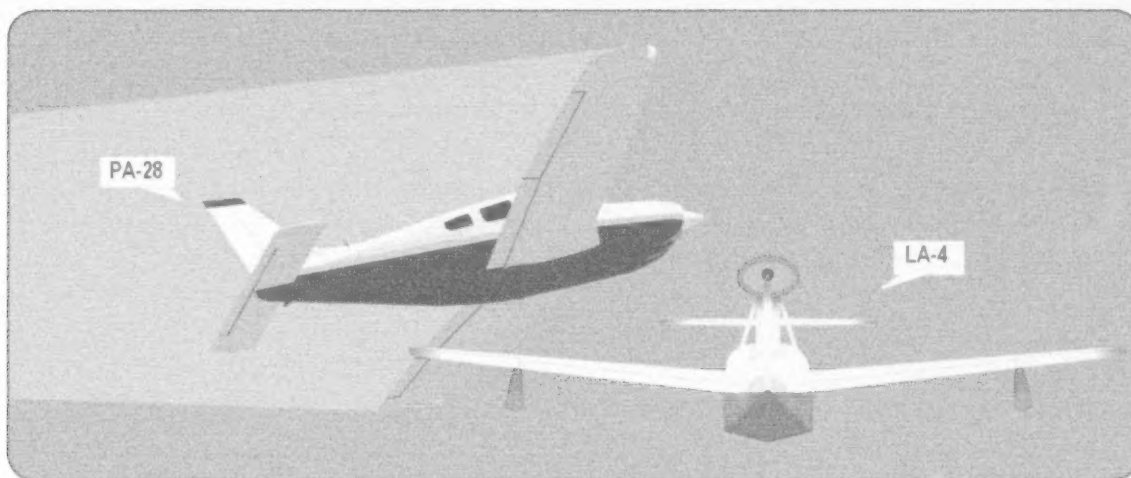
*View from cockpit of the LA-4 indicating pilot's view partly obstructed by aircraft structure  
(Note: Image not to scale.)*

its descent near Saskatoon. In order to arrive at St Brieux's elevation of 1 780 ft ASL, the pilot had to descend through 4 500 ft ASL (the LA-4's altitude). Both aircraft arrived at the same point and altitude at the same time, which resulted in a mid-air collision. The rest of this section will explain how it is possible for two aircraft to collide while being operated under VFR.

The relative position of each of the occurrence aircraft just before the collision would have made visual acquisition difficult. The PA-28 was descending from a higher altitude than the LA-4. As a result, the PA-28 may have been obscured by the left wing of the LA-4. Likewise, the LA-4 may have been obscured from the PA-28's pilot's view by the nose of the PA-28. The two diagrams indicate the positions of the aircraft relative to each other and the aircraft cockpit structures.

Both aircraft were transponder-equipped and had collision avoidance systems on board. The two aircraft were at or beyond the limits of the radar coverage required for these collision avoidance systems to operate. It is possible that one or both of the collision avoidance systems activated when the two aircraft were in range of each other and alerted either one or both of the pilots of an imminent collision. Depending on the detection range setting on the PA-28's portable collision avoidance system (PCAS), the time available for evasive action could have ranged from 2 min to as little as 4 s.

Due to the limited experience of the LA-4's pilot and the complexity of the presentation features of the traffic collision avoidance device (TCAD) system on board, it is unlikely that the pilot would have been proficient in its use and operating procedures even if the system had activated. Additionally, physiological issues related to vision may have further



*Relative positions of the aircraft at impact*

reduced the pilots' available reaction time and resulted in their inability to avoid one another.

Inspection of the damage to both aircraft left wings and ailerons indicated that the pilot of the PA-28 might have banked to the left, turning northward and away from the LA-4. This type of evasive action would have resulted in the PA-28's left wing being down to the point where it could only have come in contact with the left wing of the LA-4. A reconstruction of the likely aircraft positions at impact was prepared (see image above). The left outboard wing sections came to earth very close to each other and away from both main wreckage sites.



*Wreckage of the Lake LA-4 200 in a marsh*

This indicated that:

- they were shorn off in the air at the time of the collision;
- either one or both of the aircraft had initiated some sort of turning avoidance manoeuvre; and
- because of the structural damage, both aircraft would have been uncontrollable after the collision.

The failure of the see-and-avoid principle to avert this collision illustrates the residual risk associated with reliance on that principle as the sole means of collision avoidance.

Both aircraft cabins were crushed upon impact with their respective water surfaces, indicating that the accident was not survivable for the occupants of either aircraft.

#### *Findings as to causes and contributing factors*

1. Both aircraft arrived at the same point and altitude at the same time, which resulted in a mid-air collision.
2. The converging position of the two aircraft relative to each other coupled with physiological vision limitations likely rendered visual detection extremely difficult. As a result, the available reaction time was reduced to a point where collision avoidance was not possible.
3. The left ailerons and part of the wings from both aircraft were shorn off in mid-air during the collision. This would have rendered both aircraft uncontrollable and would have precluded either aircraft from recovering after the collision.

#### *Finding as to risk*

1. Aircraft operating in VFR conditions are at continued risk of collision when the see-and-avoid principle is relied upon as the sole means of collision avoidance.

#### *Other finding*

1. The design and operating features of the collision avoidance systems in the aircraft involved in this occurrence are such that they can inadvertently be set to detection parameters resulting in insufficient warning time for pilots.  $\Delta$

## ACCIDENT SYNOPSES

**Note:** The following accident synopses are Transportation Safety Board of Canada (TSB) Class 5 events, which occurred between February 1, 2013, and April 30, 2013. These occurrences do not meet the criteria of classes 1 through 4, and are recorded by the TSB for possible safety analysis, statistical reporting, or archival purposes. The narratives may have been updated by the TSB since publication. For more information on any individual event, please contact the TSB.

— On February 2, 2013, a ski-equipped Cessna 180E was landing on a field near Sudbury, Ont. During touchdown, the aircraft bounced, extending the landing run. The aircraft impacted a fence at the end of the field and flipped over, sustaining substantial damage. There were no injuries.

*TSB File A13O0015.*

— On February 3, 2013, a Cessna 140 took off from St-André-Avellin, Que., for Lac Agile (CSA2), Que. The aircraft landed on Runway 03 at Lac Agile. After stopping, the pilot tried to turn around on the icy runway. During the manoeuvre, the aircraft was unable to remain on the runway and the pilot cut the gas. The aircraft did not stop on the icy surface and left the runway. The aircraft struck trees. The wings were substantially damaged. The pilot was not injured. *TSB File A13Q0024.*

— On February 5, 2013, a privately registered Mooney M20K landed with its gear up at Rockcliffe Airport (CYRO), Ottawa, Ont. The aircraft sustained damage to its propeller and belly. There was no fire and the four occupants were not injured. *TSB File A13O0020.*

— On February 9, 2013, a Beech 1900C was on an IFR flight from Vancouver to Blue River (CYCP), B.C. The IFR clearance was cancelled at 9 000 ft ASL above the airport and a VFR approach to Runway 19 was carried out. After the aircraft touched down on the 60-ft wide runway, directional control was lost. The aircraft skidded sideways, departed the runway to the left and collided nose first with a large snow bank. The nose wheel collapsed, both propellers were damaged and there was possible damage to the right hand main gear. The cockpit voice recorder (CVR) will be sent to the TSB lab for data download. There were no injuries. *TSB File A13P0014.*

— On February 9, 2013, a Beech 76 Duchess departed Ottawa McDonald-Cartier International Airport (CYOW), Ont., for a local training flight. After departure, while level at 1 500 ft ASL, the left engine fuel pressure decreased to zero. Turning the boost pumps on did not affect the left engine fuel pressure. Shortly afterwards, the left engine (AVCO LYCOMING, O-360-A1G6D) began to run rough and surge, followed by a complete engine failure. The pilot declared a PAN and proceeded toward the airport. After a short time, the right engine began to run rough and surge

in the same manner as the left engine. The pilot decided to land the aircraft in a field located within the City of Ottawa. The aircraft touched down on fresh snow with the landing gear up and slid for approximately 650 ft prior to coming to a stop. There were no injuries to the two occupants. The TSB sent two investigators to the scene. The aircraft will be recovered for further examination. *TSB File A13O0023.*

— On February 10, 2013, a Cessna 172M departed Orillia Airport (CNJ4), Ont., for a test flight after recent maintenance. A loss of engine oil pressure occurred during flight, followed by an engine failure. The pilot attempted to land the aircraft on a frozen lake. During short final, the aircraft struck some trees causing a 180° rotation from the direction of flight. The aircraft sustained substantial damage but came to rest on the ice right side up. The two occupants were not injured. The TSB was deployed and found the source of the oil loss to be a cap that had come off an oil port. *TSB File A13O0024.*

— On February 14, 2013, a Stinson 108-2 airplane departed a private strip to refuel at Waterville Airport (CCW3), N.S., located approximately 10 NM to the south. The aircraft was refueled at CCW3 and the lone occupant returned to the private strip for landing. Upon landing with a slight tailwind, the right main gear contacted a snow berm along the runway edge. The aircraft was pulled to the right and nosed over, coming to a stop inverted. The pilot exited the aircraft uninjured. There was no reported fuel spill. The aircraft was righted by the pilot using a farm tractor and towed to the owner's hangar. The owner-maintained aircraft suffered substantial damage. *TSB File A13A0013.*

— On February 16, 2013, a Cameron A180 hot air balloon was being used to conduct a sightseeing tour of Kananaskis Country, 28 NM WSW of Calgary, Alta. The flight encountered severe wind and turbulence that resulted in the balloon tearing open. The pilot was able to guide the flight in a controlled descent and forced landing into trees. There were no injuries to the four occupants. *TSB File A13W0018.*

— On February 20, 2013, an Aerospatiale AS350-B3 helicopter had just dropped off skiers at the top of a ski hill, about 50 NM north of Stewart, B.C. During liftoff, the pilot lost visual reference in blowing snow. The rotors struck terrain and the helicopter rolled over. There were no injuries

but the helicopter was substantially damaged.  
*TSB File A13P0018.*

— On February 22, 2013, an amateur-built Murphy Rebel airplane was taking off at Joliette (CSG3), Que., when it struck a runway edge light with its right ski. The aircraft continued its flight to Île-Perrot Airpark (PSC6), Que. Upon landing, the right gear (skis/wheels) broke. The pilot immediately cut the engine, and the aircraft slid on the right wing and came to a stop. Nobody was injured. An examination of the aircraft revealed that the damage sustained during takeoff from CSG3 allegedly caused the breakage on landing. *TSB File A13Q0033.*

— On February 23, 2013, a privately operated Piper PA-46-310P was commencing a VFR flight from Venice (KVNC), Fla. to Fort Myers (FL59), Fla. The pilot rotated the propeller to facilitate a successful engine start (Teledyne Continental TSIO-550-C1). As the pilot cleared the propeller arc to return to the aircraft, the engine started; the aircraft moved forward on its own accord off the parking area and into a ditch. The nose landing gear collapsed resulting in substantial damage to the front of the aircraft and wings. The pilot was uninjured. *TSB File A13F0029.*



— On March 8, 2013, a Diamond DA-20-C1 took off from Québec Jean-Lesage International Airport (CYQB), Que., on a local flight with only the pilot on board. Upon landing on Runway 06, the aircraft bounced and the nose wheel hit the ground hard and collapsed. The aircraft was substantially damaged. The pilot was not injured in the accident. *TSB File A13Q0039.*

— On March 17, 2013, a privately owned Cessna 180K departed Digby (CYID), N.S., on a VFR round robin flight to Saint John (CYSJ), N.B., and Charlottetown (CYYG), P.E.I. On return to Digby, the winds were 310° at 27 kt. On the third attempt, the aircraft landed on Runway 26 and ground-looped. The aircraft's nose impacted the runway causing damage to the propeller, engine and left wing tip. The pilot was the sole occupant and was uninjured. *TSB File A13A0024.*

— On March 29, 2013, a ski-equipped Birdman Chinook ultralight took off from a private strip on a local flight. The aircraft was at a height of 500 ft AGL when it was observed in a turn heading in a westerly direction. During the turn, the bank angle increased; the aircraft pitched steeply nose down and remained in this attitude until it struck the frozen surface of Raven Lake near Espanola, Ont. The pilot sustained fatal injuries. The ultralight was found in its entirety and there was no evidence of a wreckage trail. The examination revealed that all flight controls had been connected via the flight control cable system and that disconnected control cables displayed overload failure. The Dacron skin covering the wings and empennage showed signs of deterioration; repairs to the skin had been made with household tape, silicone and substandard stitching. There was also evidence that the engine had been operating for an unknown period of time with a rich mixture which may have reduced performance. The single carburetor was secured to the engine with a rope. Damage to the propeller indicated that the engine was producing little or no power at impact. The pilot owner acquired the ultralight approximately three months prior to the accident. Investigators were unable to determine the pilot's flying experience on this ultralight. The pilot was not wearing a safety helmet; only ear protection was being worn. *TSB File A13O0053.*

— On April 1, 2013, a Poisk 06 ultralight had just departed and was climbing through 300 ft, when a structural component failed and the aircraft became uncontrollable. The pilot immediately deployed a ballistic parachute. The aircraft descended with the parachute and landed in a field near the airpark. The pilot, the sole occupant, sustained injuries during landing. *TSB File A13P0049.*

— On April 3, 2013, a Cessna 207 was departing Island Lake, Man., for St. Theresa Point, Man., on a VFR flight of about 7 mi. The aircraft departed Runway 30 at 14:55 CDT and began a left turn at about 300 ft AGL for a landing on Runway 22 at St. Theresa Point. Almost immediately, the aircraft entered whiteout conditions in snow and blowing snow. The pilot was not IFR rated but attempted to stop the rate of descent that he noticed on the vertical speed indicator (VSI). As the nose was pulled up, the aircraft flew into the snow-covered lake. There was no fire and the pilot was not injured. The pilot attempted to call the flight service station (FSS) at 14:58. Communications were not established but the FSS detected an ELT signal in the background of the transmission. The RCMP was notified and the pilot was rescued by snowmobile at 15:37. *TSB File A13C0032.*

— On April 9, 2013, an Astar AS350B3 helicopter was approaching to land in a snow-covered area at Tenquille Lake, B.C. (14 NM northwest of Pemberton, B.C.). The pilot was slowly hovering the helicopter in difficult lighting conditions

when the main rotor struck something. The pilot completed the landing, shut down the engine and found the main rotor blades badly damaged. *TSB File A13P0055.*

— On April 13, 2013, a Bell 206L1 helicopter was flying five tourists on a fishing trip to Homathko River, B.C., approximately 60 NM northeast of Campbell River, B.C. The main rotor struck terrain and separated from its root. The helicopter crashed in the river. The pilot and four passengers escaped the wreckage and made it to shore with various injuries. One passenger was found fatally injured in the submerged wreckage. *TSB File A13P0061.*

— On April 14, 2013, a Cessna 177B made a hard landing at Midland/Huron Airport (CYEE), Ont., resulting in propeller and airframe damage. The pilot decided to take off and continue to Edenvale Aerodrome (CNV8), Ont., where the aircraft landed uneventfully. There were no injuries to the pilot. *TSB File A13O0063.*

— On April 15, 2013, a Cessna 172 conducted a VFR training flight from Montréal/Mascouche (CSK3), Que., with a student pilot on board. During the initial climb after takeoff from Runway 11, the engine (Lycoming O-320-E2D) lost power and backfired. The pilot turned around to land on Runway 29. The aircraft was too high above the runway and landed on vacant land past the end of the runway. The aircraft was substantially damaged, and the pilot was transported to hospital with minor injuries. The TSB plans to participate in an engine exam at an overhaul facility in order to determine the cause of the loss of power. *TSB File A13Q0064.*

— On April 17, 2013, a ski-equipped Cessna 180H touched down on a mud- and sand-covered strip in the vicinity of Cochrane, Ont. The skis dug in and the aircraft's nose pitched down allowing the propeller to strike the surface.

As the empennage settled back on to the ground, the ground contact was of sufficient force to structurally damage the tail section. The pilot was not injured during the event. The purpose of the flight was to switch over from skis to floats. *TSB File A13O0066.*

— On April 24, 2013, a Grumman GA-7 was on a VFR flight from The Pas/Grace Lake (CJR3), Man., to Calgary/Springbank Airport (CYBW), Alta. After being airborne for approximately 3 hr and 45 min, the right engine (Avco Lycoming O-320-D1D) began to lose power. The pilot identified to ATC that he had an engine issue and requested priority at CYBW. Shortly afterwards, the left engine began to lose power; the pilot was unable to maintain altitude and conducted a forced landing approximately 9 NM north of CYBW. The pilot, who was the sole occupant, was uninjured. The aircraft sustained substantial damage. *TSB File A13W0050.*

— On April 24, 2013, the pilot of a privately owned Cessna C150 started the engine by hand. The aircraft, whose tail was attached to a cement block, started to taxi. The pilot tried unsuccessfully to climb on board, and the aircraft hit a hangar about 200 ft away. The aircraft's propeller and right wing were substantially damaged. The pilot was not injured. *TSB File A13Q0069.*

— On April 25, 2013, a Cessna 140 with two pilots on board was conducting local familiarization flights from Guelph Airport (CNC4), Ont., for the purpose of converting the pilot to tailwheel aircraft. On the landing rollout, too much brake was applied and the aircraft nosed over onto its back. There was substantial damage but no injuries. Both occupants were wearing their lap and shoulder belts. The ELT did activate. *TSB File A13O0075.* △

# THIS IS THE END!

## LANDING OVER-RUN ACCIDENTS CAN BE AVOIDED BY:

1. **Recognising** the existence of these main contributing factors, any one of which will increase landing distance considerably:
  - Approach speed too fast
  - Height at threshold too high
  - Obstacles on the approach
  - Tailwind component
  - Wet and greasy surface
  - Poor braking action
2. **Deciding** early whether to continue or abort the approach or landing
3. **Executing** immediate and correct go-around action when necessary (obstacles and terrain permitting)
4. **Avoiding** airstrips that are beyond the capabilities of you and your aircraft type



**Promoting Aviation Safety**

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# TAKE FIVE...

TP 2228-9  
(10/2013)

**for safety**

Five minutes reading could save your life!

## PIREP

"Long River radio, this is Birdman 621. I'm on a VFR flight plan between Centreville and Blanktown. I've got a PIREP for you. Turbulence is pretty bad, the visibility is dropping quite a bit and clouds are low in places. Looks like I'll be a little late on my ETA."

What is this pilot trying to say? It is obvious that he gave little useful information, even with all his good intentions. Where is he? What's his altitude? How much turbulence is there? What's the vis and cloud base? Why is his ETA off?

PIREPs are the only direct source of information on cloud heights, turbulence, visibility, winds, icing, etc., between weather reporting stations and at some airports. They are particularly important on flights below 10 000 ft. If they contain reasonably precise information, they are valuable to flight service specialists, controllers, weather briefers and forecasters—and of course, to other pilots.

There are several observation items which are valuable, such as outside air temperature, cloud types, bases and tops, thunderstorm activity and visibility restrictions. But even more important are conditions which are worse than forecast, and you should be able to describe them adequately. Here are some definitions relating to turbulence and icing, to demonstrate what we mean.

## Turbulence

**Light**—Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude. Occupants may feel a slight strain against seat-belts or shoulder straps.

**Moderate**—Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. Occupants feel definite strains against seat-belts.

**Severe**—Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Occupants are forced violently against seat-belts or shoulder straps.

## Icing

**Light**—The rate of accumulation may create a problem if flight is prolonged in this environment.

**Moderate**—The rate of accumulation is such that even short encounters become potentially hazardous, and use of de-icing equipment or diversion is required.

**Severe**—The rate of accumulation is such that de-icing or anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

Take a few more minutes to review the following sections of the **TC AIM**: MET 1.1.6, MET 2.0 and MET 3.17. For in-flight guidance, remember that the recommended contents of a PIREP are listed on the back cover of your *Canada Flight Supplement* (CFS).

**One day, your PIREP could save someone else's life...**

To view the complete *Take Five* list, please click [here](#).

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